THE ENGINEERING RECORD
PUBLISHED WEEKLY BY THE
McGraw Publishing Company
MAIN OFFICES:
114 LIBERTY STREET, NEW YORK.
BRANCH OFFICES:
PHILADELPHIA: 929 Chestnut Street.
CHICAGO: 1140 Monadnock Block.
CLEVELAND: Cuyahoga Building.
LONDON OFFICE: Hastings House, Norfolk St., Strand.

SUBSCRIPTION RATES:
United States, Canada, Cuba and Mexico....$3.00 a year.
Foreign subscription .... 6.00 a year.
25 shillings. 25 marks. 31 francs.
Foreign subscriptions may be sent to our London office.

NOTICE TO ADVERTISERS.

Change in advertisements intended for a particular issue should reach the office of THE ENGINEERING RECORD by 10 A. M. Monday of the week of issue. New advertisements can be received up to noon of Wednesday of the week of issue.

NOTICE TO SUBSCRIBERS.

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of THE ENGINEERING RECORD.

CHANGE OF ADDRESS.—The old address should be given as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

Entered at the New York Post-Office as Second Class mail matter.

Copyright, 1905, by the McGraw Publishing Co.

Of this issue of THE ENGINEERING RECORD 12,000 *copies are printed. Total circulation for* 1905 *to date,* 368,500 *copies.*

TABLE OF LEADING ARTICLES.

Large Service Pipes for Private Fire Protection.... 109
Specifications for Products from Newly Established Manufactories 109
Good Roads in Iowa.... 110
The Rights of Patents by Employes.... 110
The Superstructure of the Manhattan Bridge, New York. (Illustrated.).... 112
Roofing for Mill Buildings.... 116
Building the Beachy Head Lighthouse. (Illustrated.) 117
Electrolysis on the Metropolitan Water-Works...... 120
Replacing a Four-Track Bridge Under Heavy Traffic. (Illustrated.).... 121
Long-Distance, High-Tension Transmission in California.... 122
Cement Fence Posts.... 124
Steel Details of the Wanamaker Power House—II. (Illustrated.).... 125
Old Bridge in Western Turkey. (Illustrated.)...... 127
The Concrete Viaducts of the Thebes Bridge. (Illustrated.).... 128
Enormous Earth Dams.... 128
Stereoscopic Vision Applied to Surveying.... 129
Curing Concrete Blocks.... 130
Removal of Diverting Dam of the Ontario Power Co. (Illustrated.).... 130
Chicago Foundations 131
The Erection of the Great Tonoloway Creek Bridge. (Illustrated.) 132
Test of a 1,000-Kw. Turbo-Generator Under Service Conditions.... 134
Book Notes.... 134
Low-Pulling Portland Cements.... 135
Connecting New York and Brooklyn Water Mains.. 136
Estimates and Contracts Involving Contingencies.... 136
Counterweights for Bascules.... 136

Large Service Pipes for Private Fire Protection.

The growing tendency on the part of the insurance companies to require connections of larger and larger size from city mains to protect factories has, according to recent press reports, met with opposition in some cities—notably in Boston and Worcester—where the size of such service pipes is by ordinance limited to four inches. The reason given by these cities for their refusal to allow larger connections with their mains is that these large connections might, in case of fire on the premises which they serve, imperil the water supply and fire protection service to the general public.

The position of these New England cities would seem to be well taken from the water-works point of view. A factory equipped with the best modern system of fire protection as recommended by the insurance companies has, in addition to a number of private fire hydrants within the premises but outside the buildings, risers inside the buildings with hose outlets on each floor, and an automatic sprinkler system. The latter consists of lines of pipes suspended from the ceilings and provided with spraying nozzles designed to be opened by the fusion of a small strip of metal whenever the temperature in the neighborhood exceeds a certain predetermined degree. These pipes and nozzles are so spaced that the distance between the nozzles shall not exceed about 10 ft., so that in a large factory the total number of these nozzles, or sprinkler-heads, may readily run into tens of thousands.

The avowed purpose of the automatic sprinkler is to check fires in their incipiency. It is admitted that when a fire has spread much beyond the point where it started, it is improbable that it can be extinguished by the sprinklers, but by that time the heat of the flames will be setting off sprinkler heads all over the building and water will be pouring through them wastefully in enormous quantities.

It also frequently happens that the falling of roof, or floor, or wall, breaks off one or more of the large pipes leading either to the sprinkler system or to inside hose openings, and as it is often impossible during a fire to reach the valves controlling the supply to these pipes, some of them may be discharging their full capacity for hours, or even days, before the water can be shut off. The water which thus escapes serves no useful purpose, and its loss in quantities so large may readily deprive the general fire protection system of pressure and water supply at the very time when both are most sorely needed.

The insurance companies can hardly be blamed for endeavoring to have these service pipes to factories insured by them made as large as possible, but it would seem better, in some respects, for the protection of all concerned to limit the size of these pipes to that necessary to afford protection against fires which can be extinguished before they have gathered much headway, and then in addition to equip the factory with an independent supply and fire fighting apparatus so complete and ample as to be able to cope with fires within the premises which the ever-ready city supply has not been able to subdue.

That such independent fire protection plants can be made so complete as to satisfy the requirements of the insurance experts would seem to be abundantly proved by the fact that the lowest insurance rate given to any industry by a certain large combination of insurance companies organized for the purpose of writing only "protected risks," is that enjoyed by a match factory. And this rate was given in a town where the public water supply was delivered into the mains by pumps located within the match factory itself and operated by its employes, and where there was no reservoir or standpine on the city mains; so that, viewed in the light of a separate source of supply or of fire protection for the factory, the city's mains could be considered as non-existent. An inspection of the fire protection equipment in this match factory fully justified the wisdom of the insurance experts in giving their lowest rate to what one would suppose would be the most hazardous of all industries.

If, therefore, a match factory can, by its own fire protection apparatus alone, be made so safe as to merit the minimum insurance rate, it would seem practicable so to equip other factories, of a naturally less hazardous nature, so that they would only need, in addition to their own independent pumps and source of supply, fire service pipes of moderate size in order to meet the requirements of the insurance companies.

The special function of these fire protection connections with the city mains should be to provide water under pressure, ready at every instant of the day and night and in sufficient quantity to handle all fires which it may be possible to extinguish before they assume large proportions, the private fire apparatus of the protected plant, with an entirely separate source of supply, being relied upon, together with the city fire department, to deal with the very few fires which cannot be promptly extinguished. And in order that the city fire department may in such cases of widespread conflagration do efficient work, it is essential that the private fire protection connection to the factory should not be so large as to diminish materially the pressure on the city's mains.

Specifications for Products from Newly Established Manufactories.

In the early days of the production of certain grades of structural steel it was no uncommon feature of specifications to prescribe that material would be accepted only from those manufacturers who had been in successfully established business not less than some such period as two years. It was then considered that no steel producer would be likely to have attained reasonable certainty of excellence in his products without having passed through a period of tentative experience represented by the requirements of the specifications. The uncertainties attaching to the use of steel, while it was being introduced for structural purposes, made this requirement not so unreasonable as it might first appear. There were many disappointments resulting from the fabrication and use of steel members, which seemed almost inexplicable, and it was only a reasonable precaution to require for important structures that steel should at least be made whereby previous products had stood the test of actual trial. At the present time the successful production and fabrication of steel for all structural purposes are so well understood that they are matters of constant routine attainment, so the former precautions are no longer necessary.

Somewhat similar experiences have attended the manufacture and use of other structural materials, among which perhaps Portland cement is the most prominent. It was scarcely more than a dozen or fifteen years ago when it was supposed to be essentially impracticable, if not impossible, to produce a high grade of American Portland cement, uniform in character and reliable in its enduring qualities. There probably never was a structural material the early manufacture and use of which was hedged about with more obscurity or uncertainty. Indeed, the standard character of many high-grade Portland cements is now so well established and generally recognized that it scarcely seems possible there ever could have been any question about it whatever. Nevertheless, the pioneer manufacturers of Portland cement in this country had their trying periods of extended experimenting, both with a wide range of raw materials and in the manner of handling them, before the present uniformly reliable results were reached.

When it is reflected that Portland cement may be produced from a really great variety of raw materials possessing certain chemical characteristics in common, each set requiring different treatment for a necessary degree of excellence in results, it is not a matter of surprise that engineers should have been cautious in the acceptance of products of newly established manufacturing works. These observations are of special force when it is remembered that the older foreign cements were manufactured from certain natural materials, any variation from which was supposed to result in failure. At the present time there have been radical departures from the older precedents not only in material but in processes of manufacture. It is altogether probable, if not absolutely certain, that a Portland cement expert of forty years ago would have pronounced the most of the raw materials now used unfit for their purpose, and the present processes of manufacture unworthy of any confidence whatever.

It may be said broadly that it is a matter of no consequence to an engineer how long a producer may have been engaged in the business of manufacturing if his product will meet the requirements of reasonable testing. While this is certainly true as a general principle, the element of time is of crucial importance in the results which the engineer is to reach in the use of Portland cement. His masonry, whether of natural stone or concrete, requires months at least for the development of its desired resisting power, and his design is always based upon the confidence that after a comparatively long period of time that masonry will not only attain a high capacity of resistance, but possess it indefinitely. He has no opportunity to test the endurance of the cementing material entering his work except by such imperfect and unsatisfactory methods as those involving accelerated setting, and at best they are little better than none at all. In other words, it is not possible for him to test the most important material used in his masonry structures in the condition in which it is ultimately to perform its duties. In this respect cement is fundamentally unlike either the metals or natural stones used for structural purposes.

Under such circumstances the engineer is evidently justified in resorting to such measures as may be necessary to secure to a client beyond all reasonable doubt a specified degree of excellence in a field where the influence of chemical elements and processes of manufacture are not completely understood. On the other hand, it is maintained by many that the tentative period of Portland cement manufacture is passed and that requirements as to periods of successful production are no longer reasonable. This question depends wholly upon the state of technical knowledge regarding the composition of good Portland cement and the processes of manufacture.

While all knowledge of the influence of every element entering a good Portland cement is by no means exhausted and probably never will be, there is certainly enough known to afford reasonable control of its resisting and enduring capacity, and the same general observation may be made as to processes of manufacture. The results of a great mass of investigation have accrued which have been co-ordinated with actual experience with structures of endless variety of duties performed under even greater diversity of conditions. It certainly seems as if the manufacture and use of Portland cement had reached a point where analysis and physical tests can give sufficient assurance as to its quality to make it unnecessary to adhere to a requirement justified by the conditions existing in the infancy of its production.

Good Roads in Iowa.

Last year the Iowa Legislature designated the Iowa State College as the State Highway Commission, and the college authorities delegated the actual work of the commission to the deans of the divisions of agriculture and engineering. The appropriations for the work became available a year ago and steps were at once taken to carry out the purpose of the bill. Among other things undertaken was a complete investigation of the problem of road building in the State and of the existing conditions, and a report on this phase of the subject, which has just appeared, is one of the most encouraging contributions to the literature of roads in a long time. Instead of the tiresome and useless twaddle that is usually given out for arguments for improved highways the report is full of the facts that the careful investigations of the commission have brought to light.

The most important fact brought out, just as was the case in the recent work in Illinois, is that there is money enough raised and wasted on road work every year in Iowa to work wonders if properly spent. There are about 100,000 miles of roads in the State, of which a quarter may be classed as main roads. When these are improved so as to be in good, hard condition all the year, they will constitute such a network that no farmer will be far from one of them. This observation is not a mere generality, but is based on the mapping of the roads now in progress. A house-to-house canvass in typical townships in various parts of the State indicates that the heavy hauling in Iowa is about 55,000,000 ton-miles annually, and that the light hauling and general traffic is about 350,000,000 miles. If enough teams could be formed into a single string to do this traveling in one day, at the rate of 30 miles, it would reach about one and a half times around the globe. If regular wages were charged for the men and teams engaged in this traffic they would amount to between $30,000,000 and $40,000,000 annually. These figures, it should be added, are not the flighty generalities of the National Good Roads Association and such organizations, but the estimates of careful men of high standing in their professions. They show that there is every reason for approaching the problem of highway improvement with considerable respect for its magnitude and the interests involved.

The problem as it is viewed by the Iowa Commission is of elementary simplicity. It is how to spend the money now raised in the State so as to obtain the maximum returns from it; increased taxation is not contemplated. One reason for the latter fact is to be found in the large sums annually raised for highway work under the present laws. In 1904, $544,184.45 was raised in the county road fund, $2,283,129.64 in the township road fund, and $1,628,719.89 in the county bridge fund, a total of $4,456,033.98. There was also a considerable sum raised by poll taxes and other indirect means, which was available for road purposes. This sum, the commission points out, might have been used to advantage as follows: First, $1,000,000 might have been set aside for building permanent stone or gravel roads; at current Iowa prices, it would have been enough for 350 to 500 miles of stone roads, or 1,000 to 1,500 miles of gravel roads. Second, $750,000 might have been set aside for grading and side-ditching according to suitable plans; at current prices about 7,500,000 cu. yd. of earthwork could have been done for this sum. Third, $300,000 could have been spent for dragging every mile of earth and gravel road in the State with King road drags, thereby improving them about 100 per cent. Fourth, $2,500,000, plus the poll taxes and other indirect sums, would have been available for general repairs, bridges and administration. The pity of the situation is that all these good things, possibly even more, could have been accomplished with the same kind of system and supervision that is to be found in any enterprising business of large size. Instead, however, if the people received for their expenditures returns worth five cents on the dollar, they were probably lucky.

The eminently sensible way in which the commission is going about its work deserves a great deal of praise. In the first place it proposes to make the value of good roads felt throughout the State, and as the best way of doing this it is urging the general adoption of the King road drag implement, which, when used properly, will work wonders on any earth highway, and for an expenditure of $2.50 per mile per annum it will probably do more missionary work for the cause of improved highways than barnstorming by silver-tongued orators in every hamlet from the Mississippi to the Missouri. It will not make permanent roads, such as must sooner or later thread their way across every part of this enterprising and rich State, but it will be the inexpensive first lesson which will enable the people to learn what good roads are. And while this educational process is going on, the State Commission will be gathering together all the information necessary to work out the problem of permanent improvements and will doubtless be constructing sample roads in various parts of the State so as to prove how easy it is to do the work well when the advice of a competent supervisor can be secured. The commission states that a certain proportion of the road funds of each county and township should be set aside each year for the construction of permanent roads. A million dollars could have been set aside last year for the purpose, and, with a wise administration, more could have been accomplished with the remainder than was done with the whole sum under untrained men.

The great trouble in the past has been that the men intrusted with the spending of the money have not been taught how to go to work. With the best of intentions to be economical, they have patched here and puttered there until they have wasted all the appropriation entrusted to them without accomplishing anything but a temporary improvement. The State Commission offers to furnish free advice to the county road officers concerning all bridge and road problems, and it is to be hoped that this offer will keep a large corps of assistants at Ames busy with the questions they receive. This hope is based on the fact that the commission evidently knows what Iowa needs, is earnest in its aims and purposes, and willing to begin at the beginning and not with expensive broken stone construction. Moreover, there is nothing of the taint of graft about it, or of intentional deceit, or any other of the very bad taints and odors that some of the good roads agitation has left in communities afflicted with its "demonstrations."

The Rights to Patents by Employes.

A case of more than ordinary interest to manufacturers and engineers has been decided by the United States Circuit Court of Appeals, Third Circuit, involving the right to complete ownership of patents taken out by an employe of a company. The suit was brought by the Pressed Steel Car Co. against Mr. Hansen, formerly its chief engineer. The facts are stated by the court, 137 Fed. Rep. 403, substantially as follows: "The defendant was the company's chief engineer for a number of years, in charge of its engineering and manufacturing departments. As such, according to his testimony, part of the work he looked after was improving, and assisting in the improvement of, the company's products. He took out a number of patents on such improvements and assigned them to the company. Before he left the company's service he applied for six patents, but has since refused to assign them to the company, and the purpose of the suit is to compel him to do this. Three points are at issue: First, whether any express contract by Hansen to transfer the patents to the complainant was proved to have been made; second, whether the facts proved were such as to warrant the presumption that such a contract existed; third, whether a contract to transfer is to be implied in law from the relation between the parties. The company did not claim the existence of a written contract and the court rules that the existence of an oral contract was not proved. Consequently, the decision hinged on the third point, which is one that often arises to perplex both employer and employe.

The court reviews at considerable length previous decisions on related cases before stating its opinion. In Hapgood v. Hewitt, 7 Sup. Ct. 193, the court ruled that, in the absence of a specific contract for an assignment of patents, the utmost that could be granted the complainant was a right to use the inventions of the defendant during his employment by them to perfect their product. In Dalzell v. Dueber Watch Case Mfg. Co., 13 Sup. Ct. 886, the court stated in the syllabus of the case: "A manufacturing corporation which has employed a skilled workman for a stated compensation to take charge of its works and to devote his time and services to devising and making improvements in articles there manufactured, is not entitled to a conveyance of patents obtained for inventions made by him while so employed, in the absence of express agreement to that effect." Still another case referred to was that of Solomons v. United States, 11 Sup. Ct. 88. The complainant was the assignee of a former chief of the Bureau of Engraving and Printing, who had invented and patented a self-canceling revenue stamp. In this case the decision of the Supreme Court was equally explicit, and was as follows:

"An employe, performing all the duties assigned to him in his department of service, may exercise his inventive faculties in any direction he chooses, with the assurance that whatever invention he may thus conceive and perfect is his individual property. There is no difference between the Government and any other employer in this respect. But this general rule is subject to these limitations: If one is employed to devise or perfect an instrument, or a means for accomplishing a prescribed result, he cannot, after successfully accomplishing the work for which he was employed, plead title thereto as against his employer. That which he has been employed and paid to accomplish becomes, when accomplished, the property of his employer. Whatever rights as an individual he may have had in and to his inventive powers, and that which they are able to accomplish, he has sold in advance to his employer. So, also, when one is in the employ of another in a certain line of work, and devises an improved method or instrument for doing that work, and uses the property of his employer and the services of other employes to develop and put in practicable form his invention, and explicitly assents to the use by his employer of such invention, a jury or a court trying the facts is warranted in finding that he has so far recognized the obligations of service flowing from his employment and the benefits resulting from his use of the property, and the assistance of the co-employes, of his employer, as to have given to such employer an irrecovable license to use such invention."

It will be noticed that in all these cases the Supreme Court has recognized that the employer has the right to use all inventions made by employes under the circumstances stated at the outset, but it does not recognize the right to ownership of the patents for such inventions, in the absence of an express agreement to that effect. The Circuit Court has accordingly decided the suit of the Pressed Steel Car Co. adversely, on the ground that it did not prove any contract for its ownership of patents. While the decision may or may not be reversed if it is appealed to the Supreme Court, it is instructive on one point, and that is the necessity of making definite contracts with employes concerning the duties they are to perform. If a man is engaged to make or improve inventions he should be placed under a contract to assign all his patents for such work to his employer. This is such a self-evident matter, from a business standpoint, that it is surprising to observe how often it is overlooked. Perhaps one reason for it is to be found in the reluctance of a good many men to say directly what they wish. If they engage a man to make inventions for them they contract for all improvements he may make while in their employ, which is very different from contracting for the patents on such improvements.

Notes and Comments.

THE HEIGHT OF BUILDINGS in Budapest is fixed by ordinance according to the width of the streets. Where the latter are not more than 33 ft. wide the buildings must not exceed three stories above the ground floor, or a total of about 65 ft. Where the streets are 49 ft. or more wide four stories above the ground floor are allowed, or a total height of 82 ft. Any public building or specially designed private structure may be run up a few feet above these limits by securing permission from the city authorities.

HEN-PECKED MAN has another of his fancied exclusive fields invaded by the alleged weaker sex, for in a Wisconsin city the residents were surprised not long ago to observe a young woman engaged in laying out the lines for a sewerage system and conducting other field work incident to the public improvements just inaugurated. Women make excellent assistants in drafting rooms for certain classes of work, but they have not often taken part in field work, although there is no reason why some parts of it could not be done by them very successfully. It has generally been observed that where they are employed on office engineering work not beyond their capacity they prove more accurate than men, although somewhat less rapid workers.

THE CHATTANOOGA POWER PLANT, of 36,000 h.p. capacity, which has been receiving the attention of Mr. J. C. Guild, M. Am. Soc. C. E., of that city, for some time, is now an assured undertaking. It is proposed to construct a dam across the Tennessee River about 12 miles from the city, measured in a straight line, which will not only develop power, but will also be an important factor in the improvement of the river navigation. The dam will be a concrete structure, 57 ft. wide at the base, 9 ft. at the top and 35 ft. high, fitted at one end with a lock. The power station will be 60x300 ft. in plan and contain twelve units, somewhat different in design from those heretofore used in this country for such heads. The plans for the development have been completed, Mr. John Bogart acting as consulting engineer, and it is expected that work will be started in a short time. It is estimated that power can be delivered in the city from this plant at less than half the cost of steam power.

DRAFTING BY TYPEWRITER is accomplished successfully and speedily for some kinds of work, according to a communication to "Science" from Mr. R. A. Daly, of the International Boundary Commission. He uses the machine in making topographical and geological signs, the course of rivers and boundaries being put in by hand. For this machine work he has secured from the Hammond Typewriter Co. a number of special shuttles containing all the conventional signs needed for maps of this sort; as the Hammond machine employs shuttles which can be quickly interchanged, it is the work of but a few minutes to put in place any character that may be desired. The usual silk ribbon gives a woolly appearance to the marks and is not so good as the carbon ribbon. A highly calendared and high-grade linen paper of medium to heavy weight or a thin Bristol board is recommended for such machine drafting. It will often be necessary to make more than one impression of the key in order to secure a depth of tint which will be satisfactory for drawings to be photographed. The article is accompanied by a couple of reproductions of such drawings, which have a neat and attractive appearance.

THE MALLET COMPOUND LOCOMOTIVE of the Baltimore & Ohio R. R. has given good service during its work on the heavy grades and curves of the Connellsville division. It weighs, with tender, 479,500 lb., nearly 200,000 lb. less than two of the heaviest freight consolidation engines used on this division. The drawbar pull of the two consolidation engines is about 79,400 lb., while that of the Mallet locomotive is 74,000 lb. when working compound and 84,000 lb. when working simple. The train that can be taken up the mountains by the Mallet locomotive and one of the consolidation type is 50 per cent. greater than the train that can be handled by two consolidation locomotives. The Mallet engine has one engineer and one fireman, and the comparatively complicated details of its construction, with which the engineer must be familiar to get the best work from it, have apparently caused no trouble.

A VERY HIGH MASONRY DAM forms part of the Shoshone works near Cody, Wyo., for which the U. S. Reclamation Service will receive bids shortly. The site is a very narrow gorge about 70 ft. wide at the river bed and 180 ft. at the crest of the dam, 243 ft. higher. The structure has a width of 10 ft. at the top and 108 ft. at the river bed, and below that elevation will be carried down with vertical faces about 62 ft. to bed rock. The up-stream face has a batter of 15 per cent. and the down-stream face one of 25 per cent. The dam is curved in plan, the radius of the center line of the crest being 150 ft. The masonry will be 1:2½:5 Portland cement concrete, in which pieces of granite weighing 25 to 200 lb. will be imbedded so as to form at least 25 per cent. of the mass. The sand is to be crushed granite, passing a ¼-in. screen and containing not more than 30 per cent. of voids. The broken stone will be granite between ⅜ and 2½ in. in size. The dam will contain about 69,000 cu. yd. of masonry and its accessory works include 630 ft. of tunnel and 75,000 cu. yd. of excavation in rock and earth.

THE CONTROVERSY OVER THE STABILITY OF DAMS, which has been filling a considerable space in the British engineering press for some time, has at last brought out a very spirited communication to "Engineering" from Prof. Karl Pearson. This gentleman, with Mr. L. W. Atcherley, started the discussion in their now famous monograph "On Some Disregarded Points in the Stability of Masonry Dams," which was reviewed in this journal a few months ago. The ablest discussion of the subject up to the present time has been that of Prof. Unwin, which was recently reprinted in these pages. In his letter Prof. Pearson agrees to some extent with Prof. Unwin, but asserts that the solution they mutually uphold is not rigorously exact, and promises some more detailed information on the subject in a future monograph. His general opinion on the design of this type of structure is that empirical forms of dams have been reached which are reasonably stable; but he believes that the stability is purely empirical and cannot be demonstrated by "middle third" rules for the horizontal sections. The vertical sections are, he holds, weaker than the horizontal, and he concludes from experiments that the substratum or foundation is weaker than either. He advises extremely cautious and tentative progress in any dam construction going much beyond existing experience. He says that horizontal "middle third" stability is not, from the theoretical standpoint, a safe criterion of what is or is not reasonable in dam construction.

THE SUPERSTRUCTURE OF THE MANHATTAN BRIDGE, NEW YORK

General Description of the Third East River Suspension Bridge.

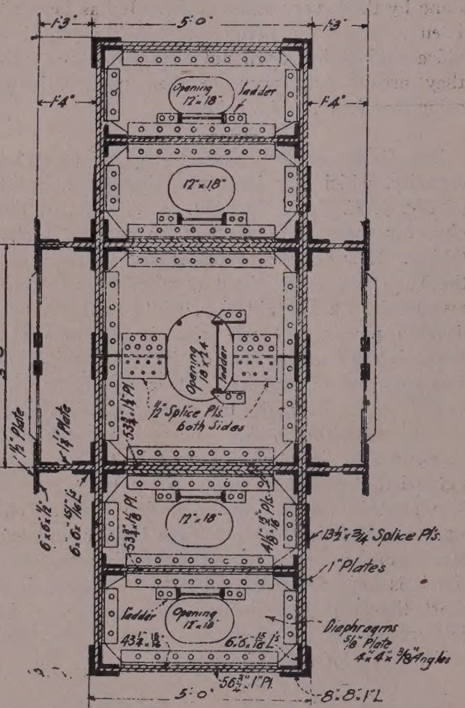
The designs for the superstructure of the Manhattan Bridge, the third suspension bridge over the East River in New York, were made public last week by the Department of Bridges. They cover a great many interesting details which it is impracticable to describe in a single article, and attention will be confined at the present time to those general features which are of interest to the whole engineering public rather than to the details with which bridge specialists alone are concerned. The structure lies just north of the Brooklyn Bridge, but it will differ widely from it and also from the Williamsburg Bridge. The Brooklyn Bridge has masonry towers; the others have steel towers. The Brooklyn Bridge has four 15¾-in. cables; the Williamsburg Bridge four of 18⅝ in., and the Manhattan Bridge will have four of 20¾ in. diameter, the largest ever used. The Brooklyn Bridge has six rudimentary stiffening trusses; those of the Williamsburg Bridge are of 40 ft. depth, and but two in number, while the four of the Manhattan Bridge will be but 24 in. high between the center lines of the chords. The Brooklyn Bridge carries a 15½-ft. footway, two tracks for elevated railway cars and two 18-ft. roadways, each considerably obstructed by a track for trolley cars. The Williamsburg Bridge has a width of 118 ft. and carries two elevated railway tracks, four trolley tracks and two 20-ft. roadways on the lower deck and light overhead footwalks. The Manhattan Bridge will have two upper decks, one on either side, with four tracks for elevated railway cars and a lower deck 120 ft. wide affording room for four trolley tracks, two 10½-ft. sidewalks and a 35-ft. roadway. The reasons for the very different cross-sections of the Williamsburg and Manhattan Bridges are to be found mainly in the different topographical conditions at the bridge terminals. The center spans of the three bridges are: Brooklyn, 1,595½ ft.; Williamsburg, 1,600 ft.; Manhattan, 1,470 ft. The side spans are 930, 596½ and 725 ft., respectively. The side spans of the Williamsburg Bridge are unsupported by the cables, while those of the remaining two structures are so carried.

Towers.—The foundations for the towers were completed some time ago. Each is a single masonry pier about 68 ft. wide and 134 ft. long at the top, which is about 23 ft. above mean high tide. They are of limestone and concrete masonry faced with granite, and rest on caissons sunk by the pneumatic process to about 92 ft. below mean high water. The design of these foundations was illustrated in this journal on March 2, 1901, and November 29, 1902, and the execution of the work was described on March 12, 1904.

On top of the masonry of each pier is a cast-steel pedestal, 42 ft. 4 in. long, 21 ft. 10 in. wide and 5 ft. 6 in. high, under each of the two legs of each half of the tower. These are made in sections, and besides being bolted together are riveted to a 1-in. bottom plate, which rests on a 1/16-in. sheet of lead laid on the masonry. The anchor bolts for the pedestals are 12½ ft. long. When the castings have been set in place they will be filled with concrete, mortar and grout, and the exposed surfaces will be finished with 2-in. of mortar molded to the curves which have been adopted as most pleasing for this portion of the structure.

The steel for the pedestals must be acid, open-hearth metal, made from stock containing at least 33⅓ per cent. of pig and not decarbonized below 0.1 per cent. in the furnace. In the ladle test the maximum limit for phosphorus is 0.05, sulphur 0.05, manganese 0.8, and silicon 0.35 per cent. Test pieces from annealed castings must show an ultimate strength of 65,000 lb., an elastic limit of 35,000 lb., and an elongation of not less than 20 per cent. in two inches. They must bend 120° without cracking around a rod having a diameter three times their thickness.

The general design of the towers is wholly unlike that of the same parts of the Williamsburg Bridge, and was governed in a measure by the fact that the masonry piers were constructed for rocking towers for a bridge with eye-bar cables.



Section of Tower Leg at El. 215.

Each half of the tower has two legs from top to bottom, although in the side elevation above the roadway it would appear as though there were four legs, arranged in two pairs. This appearance is due, however, to the fact that each leg is shaped in plan like a cross, and the lattice angles which are indicated on the elevation really connect the faces of two ends of the cross, as shown in the plan of one of these legs. This plan also indicates sufficiently for the purpose of this article the general character of the construction of the legs.

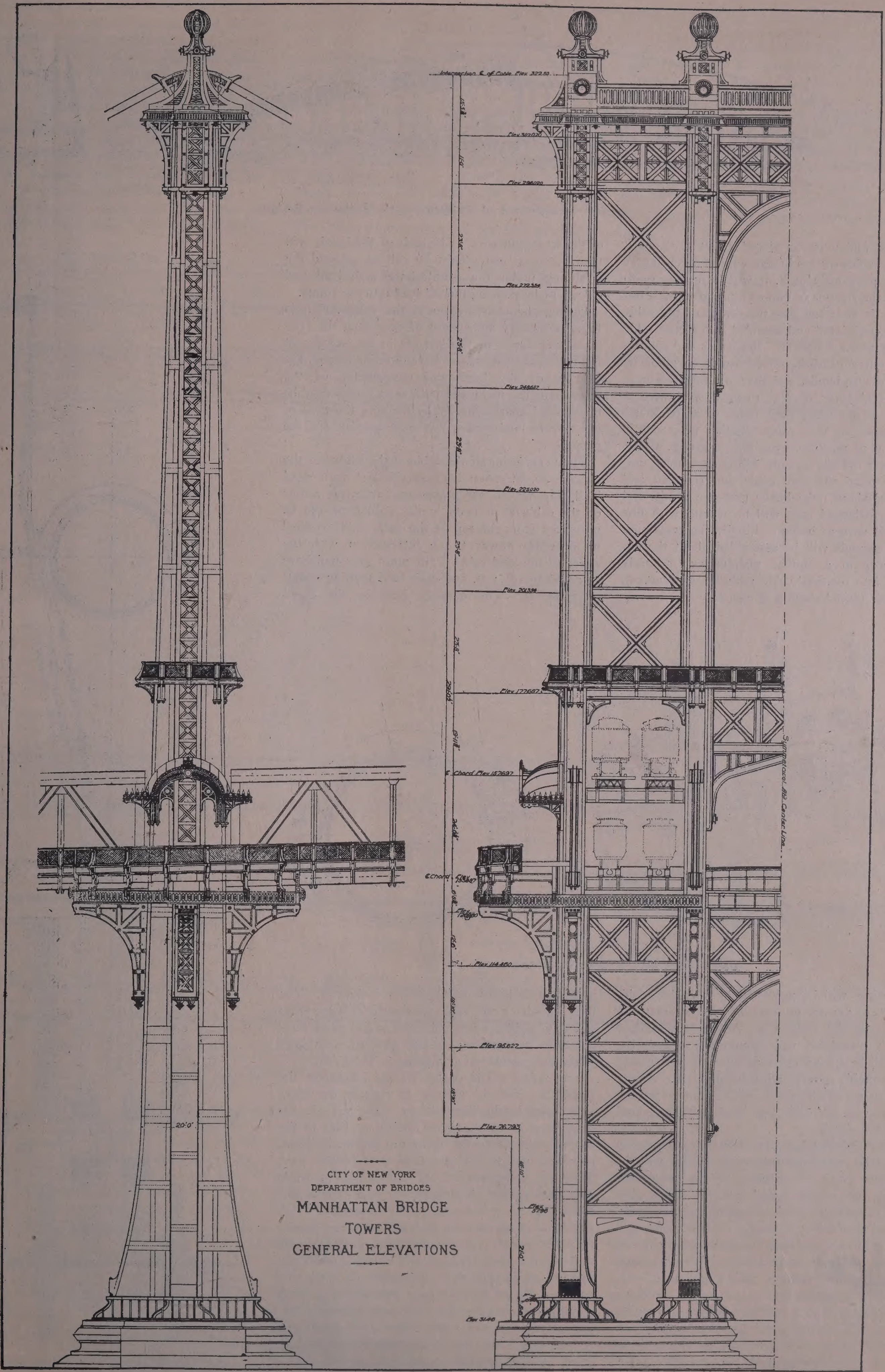
The towers will be built entirely of carbon steel, except for the minor details of cast iron, wrought iron and bronze. The requirements for the metal depart materially from those usually given in bridge specifications, as is natural in a structure of such magnitude. It must be made of pig iron, washed pig or a combination of the two, in an acid furnace; scrap resulting from previous heats for this contract may be used in quantities up to 25 per cent. of the charge. Decarbonization below 0.12 per cent. will not be allowed. No stock with more than 0.1 per cent. phosphorus and 0.04 per cent. sulphur will be permitted. The ladle test must not show more than the following amounts of the elements mentioned: Phosphorus, 0.04; sulphur, 0.04; manganese, 0.6; silicon, 0.1 per cent. The amount of discard from the top and bottom of ingots is left to the judgment of the inspector. The material is required to have an ultimate strength of 60,000 to 68,000 lb., an elastic limit of at least 33,000 lb., an elongation in 8 in. of at least 1,500,000 ÷ ultimate strength, and a minimum reduction in area of 44 per cent. Two-inch specimens must bend cold 180° around a rod equal in diameter to the thickness of the specimen, and must bend flat when at or above a red heat. Rivet steel for this part of the work must not exceed 0.035 phosphorus and 0.03 sulphur in ladle tests and must have an ultimate strength of 50,000 to 58,000 lb., a minimum elastic limit of 30,000 lb., the same elongation as the material for shapes and plates and a reduction in area of 50 per cent.

Anchorages.—The anchorages of this bridge were described at length in The Engineering Record of Dec. 17, 1904. That article explained the arrangement of the anchorage chains for the main cables and also the anchorage for the end of the stiffening truss.

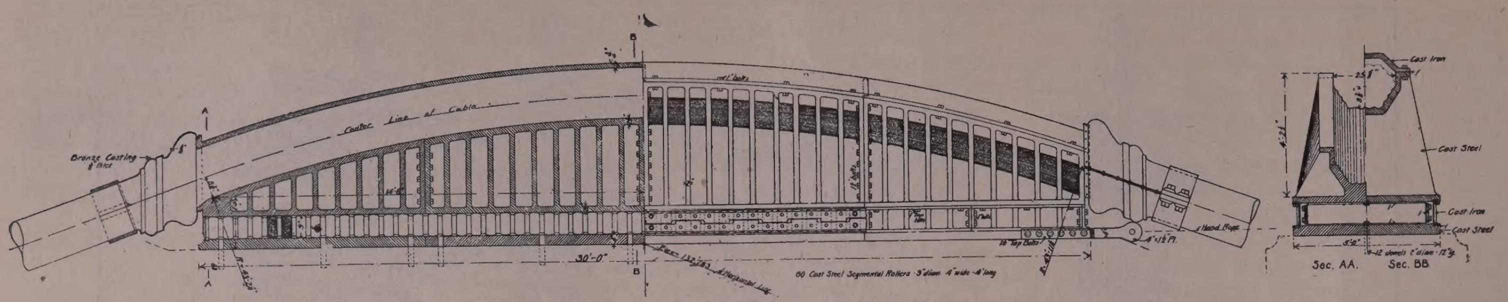
Cables.—Each of the four 20¾-in. cables will consist of 37 strands and will contain 9,472 parallel wires 0.192 in. in diameter before galvanizing. The wire will be made in acid furnaces from stock consisting only of pig iron and approved acid steel scrap having not more than 0.06 per cent. of phosphorus and 0.04 of sulphur. During reduction decarbonization below 0.2 will not be permitted. The ladle tests must not show more than 0.85 carbon, 0.55 manganese, 0.2 silicon, 0.04 phosphorus, 0.04 sulphur, and 0.02 copper. At least 30 per cent. of the weight of the ingot must be discarded.

The wire for the cables, as well as that for the hand ropes and the suspenders, must have an ultimate strength of not less than 215,000 lb. before galvanizing and an elongation of not less than 2 per cent. in 12 in. The bright wire must be capable of coiling around a rod 1½ times its own diameter without sign of fracture. It must be finished in single lengths of at least 3,000 ft. and will be spliced with sleeves having right and left-hand screw threads, the wire ends being tapped to correspond in field splicing, while in the shop the wires must be given cold-rolled threads and mitered ends for locking the splice. All splices will be soldered. All the wire for the cables, serving, hand ropes and suspenders will be galvanized.

In the operation of cable making each strand will be built several feet higher than its final position when laid in the cable. To do this a shoe will be placed at each end of the strand a previously determined distance back of its final position, and the strand will be carried on sheaves above the grooves of the cable saddles on the towers and at the anchorages. When the strand is finished it will be lowered into the saddle grooves, the shoes will be placed on the permanent pins at the ends of the anchor chains and the strand will be adjusted to its proper versed sine by means of fillers between the shoes and the pins. When all the wires of a strand have been laid in place and before the strand is put in its final position in the cable, it will be bound together by bands to keep the wires in their proper place. These bands will be made of five or six turns of No. 10 wire securely locked and will be placed at intervals not exceeding 5 ft. On the ends of the strands within the anchorages these bands will be



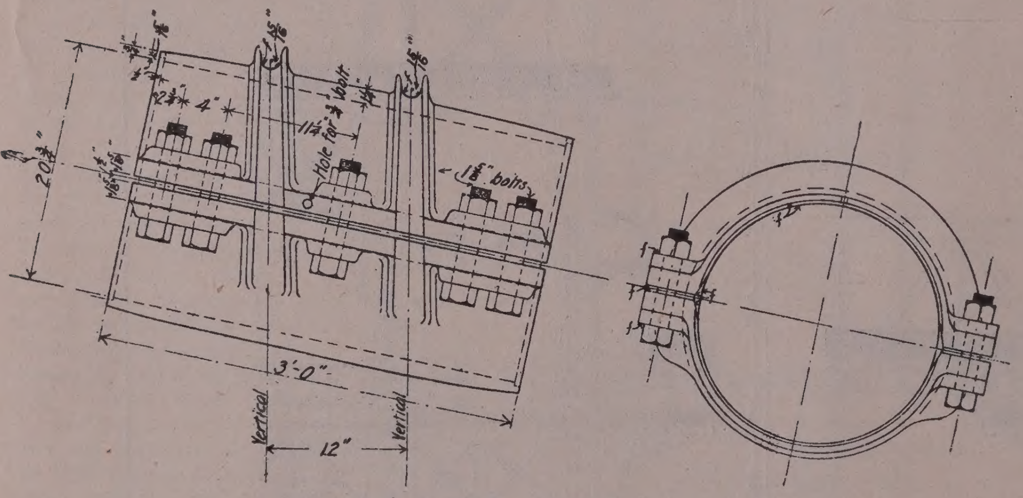
CITY OF NEW YORK
DEPARTMENT OF BRIDGES
MANHATTAN BRIDGE
TOWERS
GENERAL ELEVATIONS



General Arrangement of Saddles on the Manhattan Bridge.

permanent and must be placed about 2 ft. apart.

As the cables of this bridge will be much larger than any previously built, it will be necessary to assemble the strands in two or more groups. First the seven strands forming the center of the cable will be consolidated and rounded into a core cable by removing the temporary wire bands and squeezing the wires of these core strands together by heavy pressure bands, and then winding this core with several turns of No. 16 plow steel wire at intervals of not more than 10 ft. so as to secure the wires of the core cable together permanently in their true position. Second, a group of the twelve next outside strands will be assembled uniformly around the core cable and rounded and compacted about it by heavy pressure bands, and then this enlarged core will be wound with fine plow steel wire as before. Finally the remaining eighteen strands will be assembled about the enlarged core in a similar manner and securely wrapped into the final cable with No. 8 wrapping wire bands placed about 4 ft. apart.



Cable Band with Grooves for Suspenders.

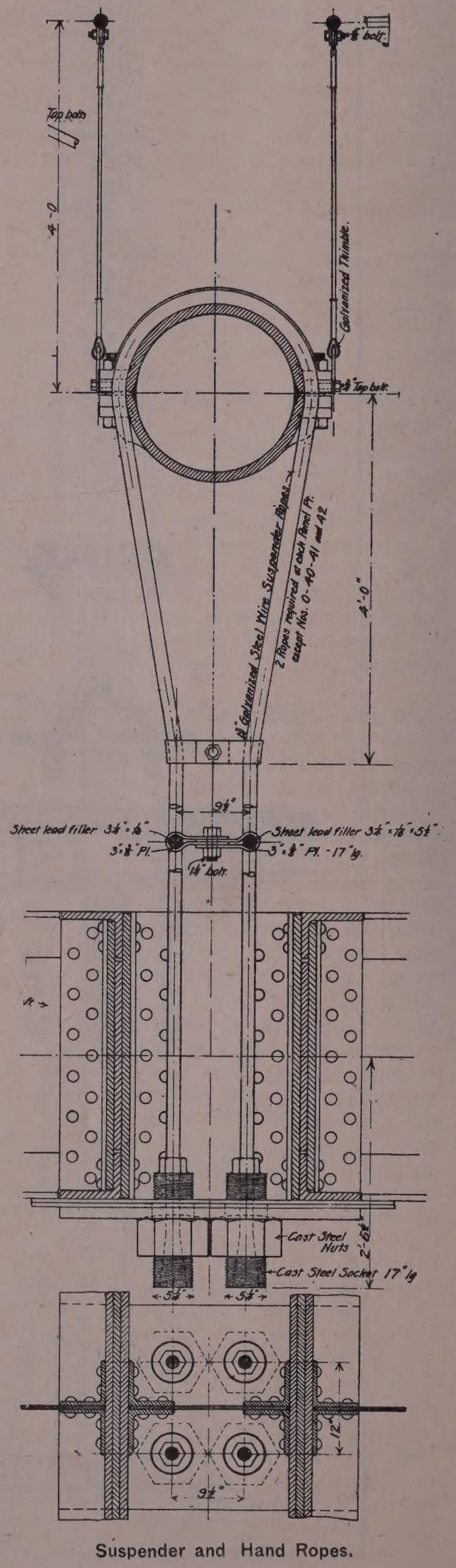
The wires will be protected by a cable shield, so-called, of neutral mineral oil or other material approved by the engineers. As each individual strand is completed and temporarily seized, the wires will be spread apart as much as practicable and thoroughly covered with this material. Again, as each group of strands is finally bound together the surface of the cable will be given a final coat of the cable shield.

When each cable has been fully compacted and banded, the cast-iron suspender bands will be bolted into place accurately. Before doing this the cable under the bands will be thoroughly cleaned of oil and receive a coat of red lead paste. The final protecting covering of the cables will be a continuous serving between the cast-steel suspender bands of round galvanized Norway iron wire, applied under stress, following immediately a thorough squeezing of the cables into compact cylindrical form by powerful clamps. The wire wrapping will extend under the ends of the cast-steel cable bands, which will be counterbored at each end to receive at least two complete turns of the wrapping wire. The ends of the bands will then be made water-tight by calking around the wrapping under the counterbore with lead and oakum or by pouring melted lead into the joints.

During the construction of the cables, if it is found necessary on account of exceeding the frictional resistance of the strands in the saddles at the top of the towers, or for any other reason, the balance of the horizontal components of the stresses in the main and land span cables may be maintained approximately by bending the tops of the towers landward a sufficient amount for the purpose.

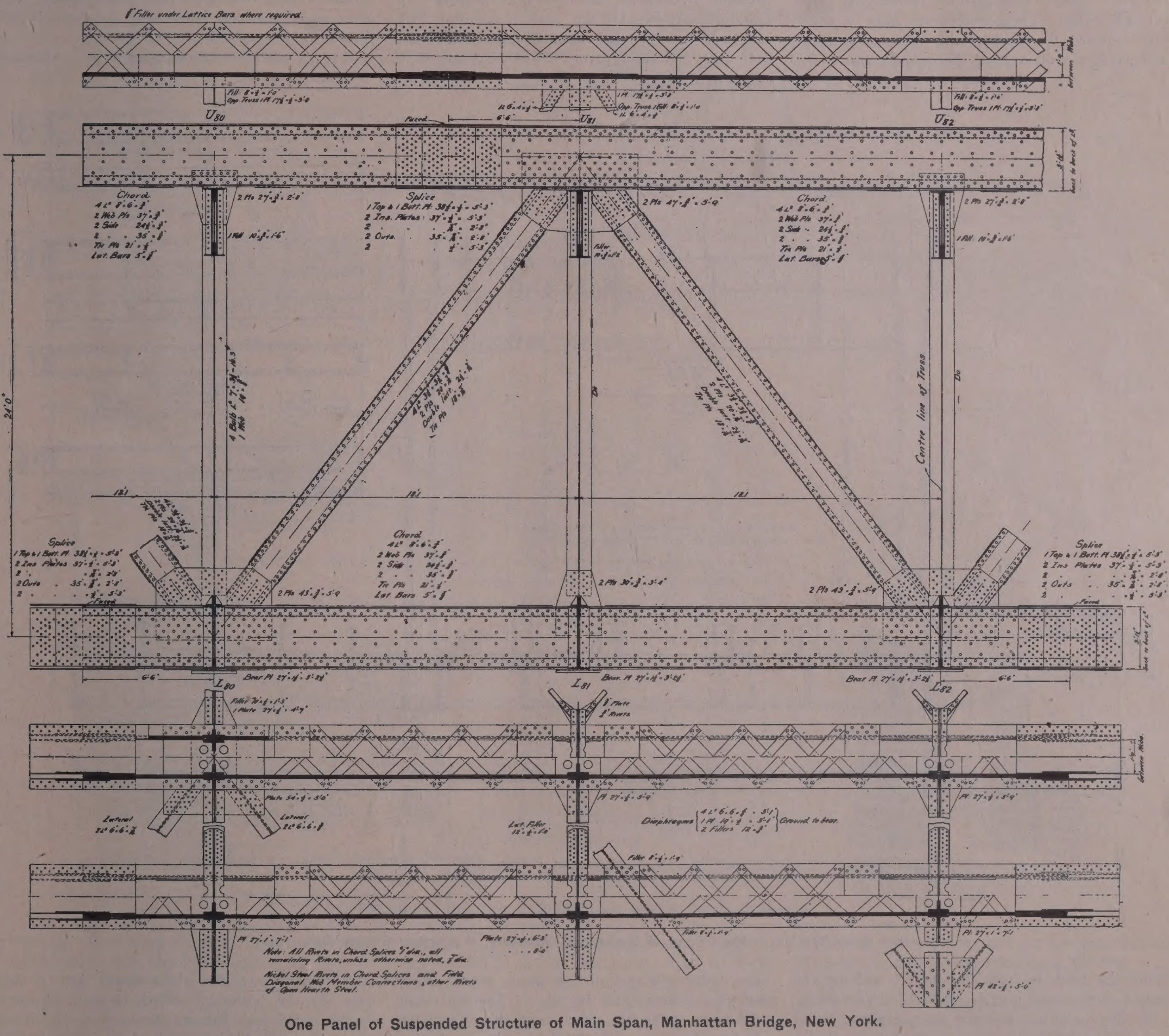
The versed sine of the cable at the center of the main span, at mean temperature and with dead load only, will be 148.5 measured from the center of the cable as it rests in the saddle, or 150 ft. measured from the top of the cable curve carried up over the tower to an intersection with the curve of the land cable. The main span will have 78 panels of 18.1 ft. and each land span 40 panels of 17.85 ft. The distance between the panel points on each side of the tower is 40.1 ft. The total length of the cable in the main span, from saddle to saddle, when unloaded and at mean temperature, is 1,498.68 ft., and that of each land cable from saddle to anchorage is 762.93 ft.

Suspenders.—The design of the bands for the suspenders and the manner of rigging the latter are shown in the illustrations. The wire in the suspenders is of the same quality as that in the cables. The suspender ropes are 1¾ in. in diameter and weigh not less than 5.1 lb. per foot. They are composed of six strands of 19 wires each, laid around an independent wire rope center consisting of 49 wires in a left-hand lay. Full size tests of suspenders and the cast-steel screw-threaded sockets used with them will be made to determine their strength and modulus of stretch for use in getting the true length of each suspender. There will be four suspenders at each panel point of each cable, obtained by looping two suspender ropes over each cable band. Each pair of suspenders will be drawn together about 4 ft. below the center of the cable.



Suspender and Hand Ropes.

Suspended Superstructure.—It is impracticable at this time to give details of the suspended superstructure, but its general arrangement is shown on the accompanying illustrations. The main parts of the chords and of the diagonal web members of the trusses, the gusset plates connecting the diagonal web members to the chords and the chord splices will be made of nickel steel or of high carbon steel. The connections of the chord splices and diagonal web members of the stiffening trusses shall be made with nickel steel rivets or by carbon steel rivets of equivalent strength.


U80
U81
U82
L80
L81
L82
Chord
Splice
24'0"
18'
Centre line of Truss
Note: All Rivets in Chord Splices 1" dia., all remaining Rivets, unless otherwise noted, 7/8" dia.
Nickel Steel Rivets in Chord Splices and Field Diagonal Web Member Connections, other Rivets of Open Hearth Steel.

One Panel of Suspended Structure of Main Span, Manhattan Bridge, New York.

The ladle test of the nickel steel is the same as that for carbon steel already stated, except that the metal must show not less than 3.25 per cent. of nickel. The nickel steel for rivets must have 3.25 per cent. of nickel and not more than 0.035 phosphorus and 0.03 sulphur. The physical requirements of the nickel steel and high carbon steel are given in the accompanying table.

PHYSICAL REQUIREMENTS FOR NICKEL AND HIGH CARBON STEEL.

	High Carbon.	Nickel.
Ultimate strength......	85,000 to 95,000	85,000 to 95,000
Elastic limit............	45,000	55,000
Elongation, 8 in........	1,500,000 ÷ ult.	1,600,000 ÷ ult.
Reduction in area.......	35	40

Specimens of both nickel and high carbon steel not less than 2 in. wide must bend 180° around a rod of a diameter equal to twice the thickness of the specimen without a sign of fracture.

The maximum working stresses for dead load, temperature and congested live load, or for dead load, regular live load, temperature and wind for the two metals are as follows:

Tension in stiffening trusses, 40,000 lb. for nickel and 35,000 lb. for high carbon steel.

Compression in stiffening trusses, 40,000 — (150 $L \div R$) for nickel steel and 35,000 — (135 $L \div R$) for high carbon steel.

Shear on shop rivets and bolts, 16,000 lb. for nickel steel; bearing, 30,000 lb.

The shop requirements for the two grades of metal also differ. High carbon steel of all thicknesses must be drilled out of the solid. Plates and angles of nickel steel not exceeding 5/8 in. in thickness may be punched 1/8 in. smaller than the rivet to be used and then reamed.

Loads.—The bridge is proportioned to carry the following loads, in addition to its own weight.

Cables, trusses and towers: (*A*) A load of 8,000 lb. per lin. ft. as regular, or (*B*) 16,000 lb. per lin. ft. of bridge as congested traffic.

Hangers, floorbeams and floor system: (*C*) On each elevated railway track a load of 52 tons on four axles, 6 ft. + 10 ft. + 6 ft. apart, equivalent to the axle spacing of the motor ends of two motor cars of the Interborough Rapid Transit Co. (*D*) On each street car track either a load of 26 tons on two axles 10 ft. apart or a load of 1,800 lb. per lin. ft. of track. (*E*) On any part of the roadway a load of 24 tons on two axles 10 ft. apart and 5-ft. gauge, assumed to occupy a width of 12 ft. and a length of 30 ft., and upon the remaining portion of the floor a load of 100 lb. per sq. ft. (*F*) On the footwalks a load of 100 lb. per sq. ft. The wind pressure is assumed as a moving load acting in either direction horizontally with 2,000 lb. per lin. ft., "but due allowance is made by taking lateral deflection into account."

In conclusion, it should be added that the terms of the contract call for the completion of the work not later than Jan. 1, 1909.

AN ELECTRICALLY DRIVEN OIL BOAT, 245 ft. long, 32 ft. beam and rated at 1,100 tons, has been built for the Russian oil trade, using three Diesel oil engines for the production of power, which is transmitted electrically to motors operating the propellers. The engines are placed amidships, and the oil tanks forward and aft. The entire control equipment for the motors is located in the pilot house, thus doing away with all signaling apparatus to the engine room.

Roofing for Mill Buildings.

Some time ago Mr. Edward Atkinson issued a bulletin from the experiment station of the Boston Manufacturers' Mutual Fire Insurance Co., of which he is president, containing the following paragraph: "We have accepted the tar and gravel roofing put on by reputable concerns with a warning to our members to be certain that the tar is of a suitable quality and not volatile; we have also accepted the Carey roofing and many other types of a somewhat similar character, without discrimination, believing them all to be substantially equal in the matter of fire hazard." These remarks refer to the "flat" type of mill roofs. These sometimes have a slight pitch toward the center, with interior drainage and parapet walls around the outside, and sometimes the pitch is from the center, without any boxed cornice and usually without eaves troughs.

In the quotation referred to one phase taken out of its context has been assumed to be an indication of distrust of the tar and gravel roofing as a fire, spark and cinder resistant. Such an inference, according to a recent bulletin, is without any support in fact or intention. There are several compositions of tar and gravel and of other materials, such as the Carey roofing, the Flintkote roofing or canvas, which are and have been used for covering what are known as flat roofs for many years, each and all of which are accepted by Mr. Atkinson's company as of equal value in resisting the hazards of fire without any discrimination or difference in rate when put on by contractors of repute whose workmanship can be trusted. In fact, the question hardly comes up for consideration in reviewing any risk. Each and all of these compositions must be made of suitable material, and each and all, when so made, are equal.

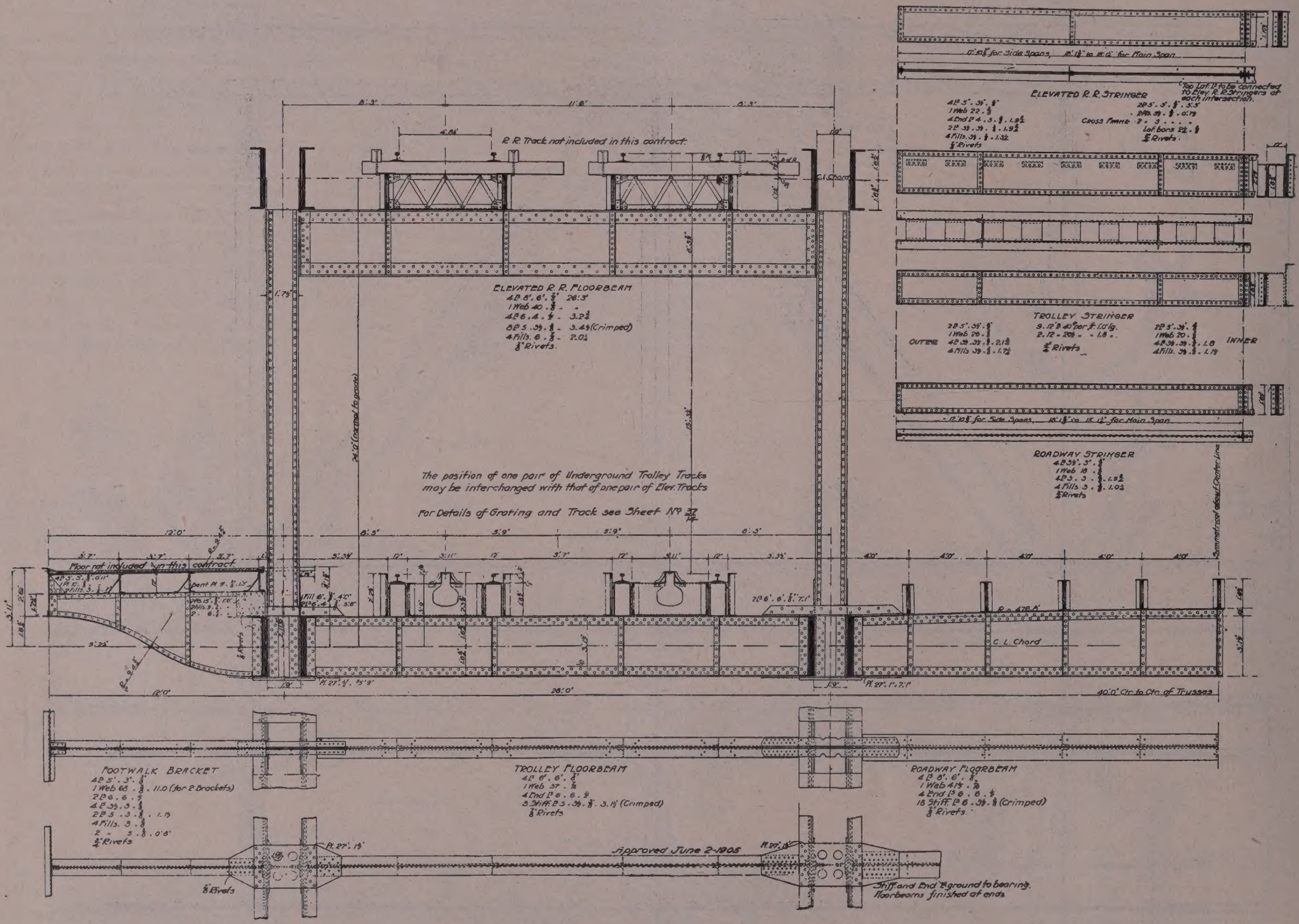
The roof approved by the Mutual Underwriters is of what is called mill or slow-burning construction. These roofs have been covered with tin, with painted canvas, with tar and gravel and other compositions. There is but one case on record where such a roof has been burned through from outside; in that case with very trifling loss within. There is no record of what the covering of that roof consisted.

Mr. Atkinson used and advised in some cases covering a roof with canvas or duck, painted. In one instance one-half the roof of a large duck mill was covered with painted duck; the other half with tar and gravel. These sections were kept under observation for many years. Each was as satisfactory as the other. The mill being no longer under his supervision, the record has not been kept up. The sparks, cinders and other outside causes of ignition, whether coming from chimneys, furnaces, cupolas or other sources within the yard of the insured premises or from buildings outside the yard, are readily extinguished on either kind of roofing.

The barn type of roof of about 45 deg. pitch, covered with slate, is dangerous and unfit, Mr. Atkinson states. Nearly all such roofs on Factory Mutual risks have been removed and a deck roof substituted. The dangers consist in sparks which pass readily through the cracks between the slate; the slate cracks under heat, making the approach to the roof by firemen dangerous. This barn roof, formerly very common, was built of plank rafters, 18 to 24 in. on centers, boarded and covered with slate, generally sheathed within on the rafters, making a dangerous hollow space. Buildings surmounted by such roofs are no longer considered insurable in the Factory Mutual system. It was to such a roof that the fire was carried from the basement through an open shaft in the great Boston conflagration. From this roof the fire was carried to other roofs of the same kind or of the mansard type, spreading the conflagration in one case across a street 120 ft. wide. For these reasons the safe and suitable covering for the flat roof becomes a matter of paramount importance, the flat roof properly covered being the safest roof under which valuable machinery and goods may be readily protected.

Not to use such roof spaces, Mr. Atkinson says, is a waste of the whole area of ground covered by the building. When safety, economy, utility and health become the motives governing the design of buildings, and when architects give regard to the purposes to which buildings are to be put before making their plans and elevations, the flat roof or roof of ½-in. pitch may well displace every other type of roof upon city dwellings and upon all hospitals, schoolhouses, factories and workshops.

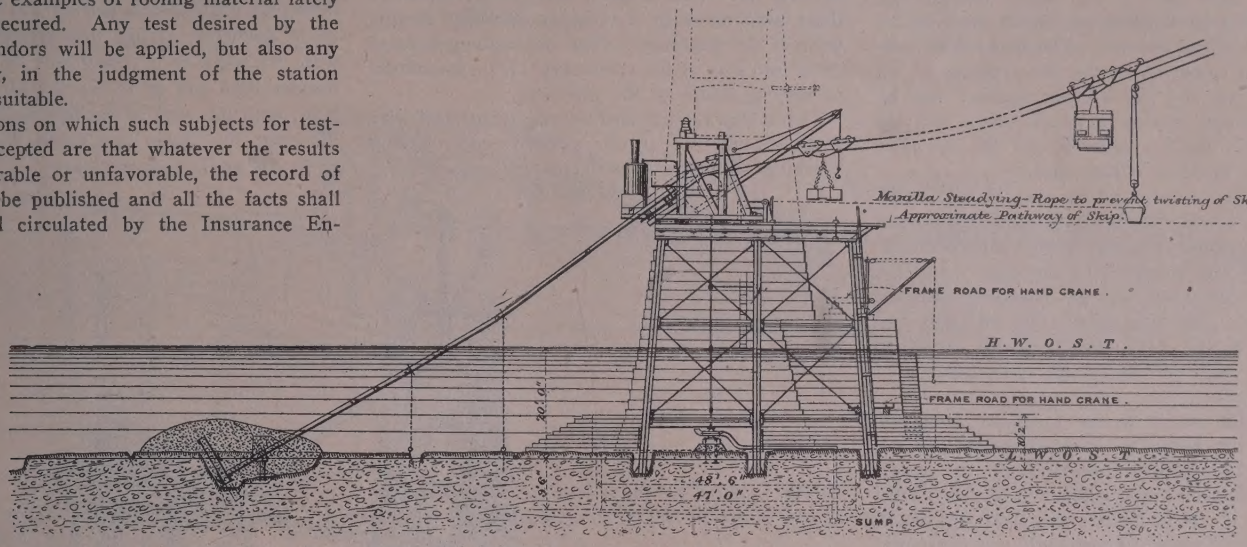
In view of the misapprehension that has arisen in this matter, arrangements are now being perfected at the experiment station for a comparative test of all roof coverings that may be offered by any maker of repute who will agree to bear a due proportion of the expense of such a test. The conditions of this and of all other tests are as follows:


ELEVATED R. R. STRINGER
ELEVATED R. R. FLOORBEAM
R. R. Track not included in this contract
TROLLEY STRINGER
OUTER
INNER
ROADWAY STRINGER
The position of one pair of Underground Trolley Tracks may be interchanged with that of one pair of Elev. Tracks
For Details of Grating and Track see Sheet No 37
Floor not included in this contract
C. L. Chord
40'0" Ctr. to Ctr. of Trusses
FOOTWALK BRACKET
TROLLEY FLOORBEAM
ROADWAY FLOORBEAM
Approved June 2-1905
Stiff and End ∠s ground to bearing. Floorbeams finished at ends.

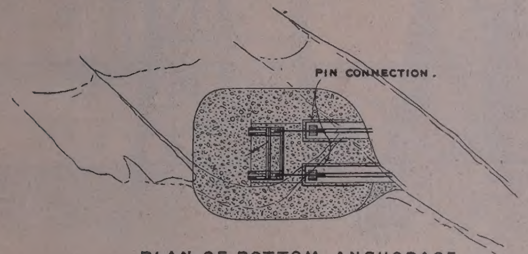
Half Cross-Section of Main Span of Suspended Structure, Manhattan Bridge, New York.

Roof coverings or other materials submitted for tests may be supplied by owners in any form or condition that they may elect. They must correspond as closely as possible to the commercial product offered in the market. In order to be assured that such examples do correspond with the commercial product, examples of that product will be secured from the stock on sale, and whenever possible examples of the product that have been subject to use for many years will also be secured, as the examples of roofing material lately tested were secured. Any test desired by the makers or vendors will be applied, but also any test that may, in the judgment of the station directors, be suitable.

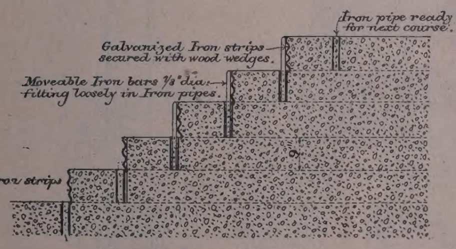
The conditions on which such subjects for testing will be accepted are that whatever the results may be, favorable or unfavorable, the record of the test shall be published and all the facts shall be stated and circulated by the Insurance Engineering Experiment Station. It is the purpose to make these tests absolutely impartial and judicial, as the directors are well aware that if the least personal bias should appear, or indication of favor to any one contributor more than another, the usefulness of the service would be ended. Thus far attention has been directed to composition roofing on roofs of mill construction. There are in cities many flat roofs of bad construction, sometimes consisting of only 1-in. boards laid on joists 18 to 24 in. on centers. On these roofs large quantities of burning material may fall from adjacent fires. If it is desired by the makers of composition roofs to imitate these conditions by setting fire to a pile of combustible material upon a composition roof and to measure the time required for its destruction, such sections may be supplied and such tests may be made, to be reported for whatever they may be worth.


Manilla Steadying-Rope to prevent twisting of Skip.
Approximate Pathway of Skip.
FRAME ROAD FOR HAND CRANE.
H. W. O. S. T.
FRAME ROAD FOR HAND CRANE.
20' 0"
9' 6"
48' 6"
47' 0"
10' 2"
L. W. O. S. T.
SUMP

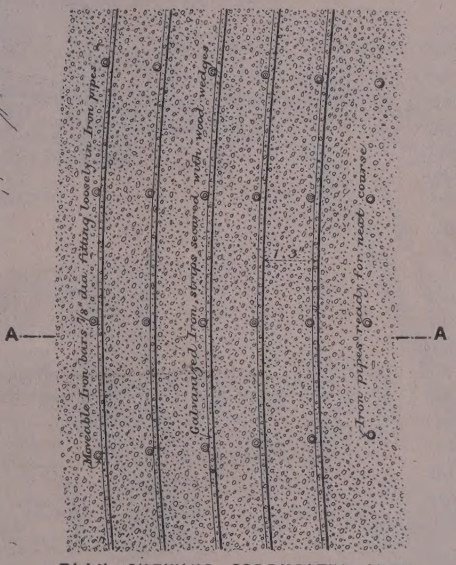
GENERAL ELEVATION OF BOTTOM ANCHORAGE, SEA STAGE, DAM AND CABLEWAY.



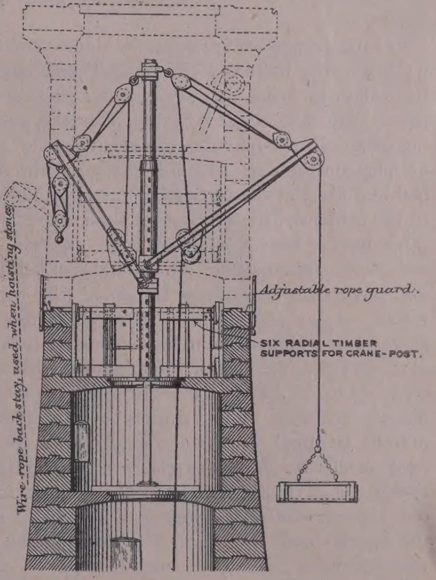
PLAN OF BOTTOM ANCHORAGE.


Iron pipe ready for next course.
Galvanized Iron strips secured with wood wedges.
Moveable Iron bars 7/8" dia. fitting loosely in Iron pipes.
Galvanized Iron strips

SECTION A A.
SHEWING CORRUGATED IRON SHUTTERING.


A
A
Moveable Iron bars 7/8" dia. fitting loosely in Iron pipes.
Galvanized Iron strips secured with wood wedges
1' 3"
Iron pipes ready for next course

PLAN SHEWING CORRUGATED IRON SHUTTERING FOR DAM.


Wire-rope back stay, used when hoisting stones
Adjustable rope guard.
SIX RADIAL TIMBER SUPPORTS FOR CRANE-POST.

SECTIONAL ELEVATION
SHEWING SETTING ARRANGEMENTS
FOR UPPER PART OF TOWER.

Details of Plant Used in Building the Beachy Head Lighthouse.

Building the Beachy Head Lighthouse.

The new Beachy Head lighthouse, which was recently built by the authorities of Trinity House, stands about 700 ft. from a cliff on the foreshore, between the low-water elevations of spring and neap tides. It is a granite tower with seven living rooms, the usual compartments for stores and a lantern of the first order, with its focal plane 103 ft. above high spring tide. The structure was designed by Mr. T. Matthews, engineer-in-chief to the Trinity House, and the method of building it was described in an interesting paper recently submitted to the Institution of Civil Engineers by Mr. Albert H. Case, who was the resident engineer during construction. From his paper the following notes and illustrations have been taken.

Means of Access to the Site.—The cliffs facing the site rise vertically to a height of about 430 ft. Access by sea would have been subject to interruption, except during calm weather, owing to the rocky and shallow nature of the foreshore, and a line of rails laid from a work-yard at the nearest point along the cliffs to the site would have been a costly undertaking, expensive to maintain and subject to continual interruption from rough seas at high water, falls of chalk cliff, etc. It was, therefore, decided to locate a work-yard and depot on the top of the cliff, immediately facing the site of the tower, and to connect this depot by means of a cableway to a small working platform or sea-stage erected on piles close alongside the tower, thus securing uninterrupted access independently of the sea.

The deck of the sea-stage, 37x26 ft., was 23 ft. above high water of spring tides, and was built of steel girders and rolled joists, with 4-in. deck planking laid with 1-in. spaces. It was carried on nine steel built-up piles, the feet of which furnished with flat plates, were concreted into holes, 5 ft. in depth, excavated in the rock. Each pile after erection was filled with 6 to 1 Portland cement concrete to a height of 7 ft. above the rock surface. The material for erection was brought at high water as near as possible to the site by steamer and was thrown overboard; at extreme low water of spring tides it was removed over the rocks to the place of erection as required. The workmen walked to and from Eastbourne along the beach at each tide, as their work could only be carried on at low water. At times they retired to a small hut erected on a "fall" at the foot of the cliffs about a half-mile to the east, where also small stores were kept.

The sloping nature of the ground surface at the site of the work-yard necessitated considerable excavation and embankment in order to form the depot and its approach roads. In addition to the ordinary work shops, stores and offices, workmen's barracks were erected to provide sleeping and living accommodation for 24 men, and at a later date it was found advisable to augment this by building additional sleeping accommodation for 20 men. The maximum number of men employed during the progress of the work was 53, and the average number was 28. The maximum weekly pay was £100, and the average was £44 8*s.*, equal to 31*s.* 8*d.* per man, including a foreman in each case.

The necessary water for boilers and for domestic purposes was obtained from the Eastbourne Water Company at a cost of 1*s.* per 1,000 imp. gal., which was increased by the cost of haulage to 33*s.* 6*d.* per 1,000 imp. gal. delivered into the yard tanks. The rain water from all roofs and buildings in the yard was carefully stored in galvanized tanks having an aggregate capacity of 8,000 imp. gal.

To provide access to the foreshore from the depôt on the cliffs, in order to carry out the various initial works connected with the installation of the cableway, a path or ladderway, comprising 370 lin. ft. of ladders and about 375 lin. ft. of rough-hewn zigzag stepped path, was constructed on the face of the cliff; this was made, maintained for more than three years, and removed, at an inclusive cost of £105, and proved of great service.

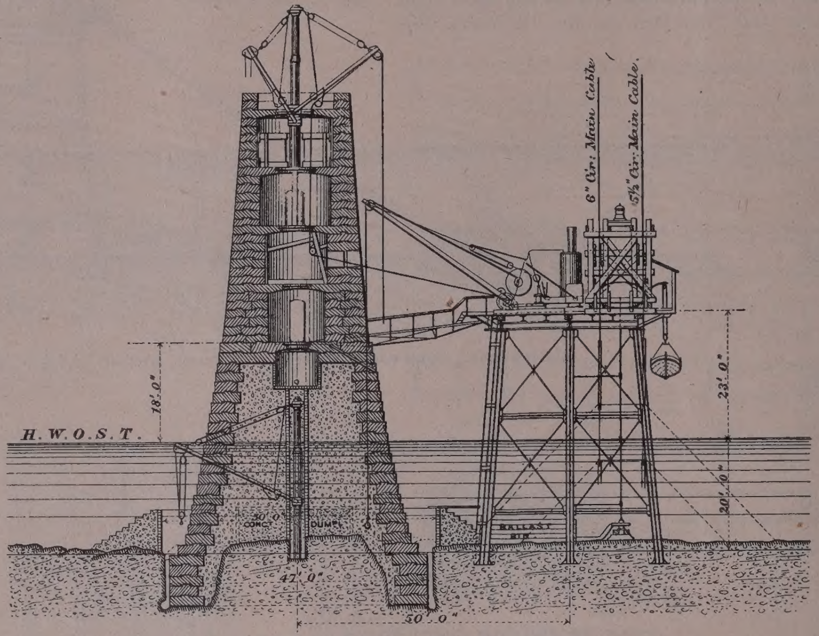
For the purpose of lowering the timber and ironwork for the bottom terminal and anchorage of the cableway from the work-yard above, a temporary light and rough ropeway was used, consisting of an old 1½-in. wire-rope secured over a pair of spars on the deck of the sea-stage at the lower end and fixed at the top end to the upper terminal of the cableway, the erection of these upper structures having been completed while the sea-stage was under construction. An ordinary snatch-block was run up and down over this fixed wire-rope by means of a 3-in. manila rope; the necessary power was obtained from the steam jenny of the yard traveler, the heaviest load dealt with being only 6 to 8 cwts. For the lowering of the heavier parts of the machinery to complete the bottom terminal, one end of the 2⅞-in. permanent steel-wire hauling-rope was stretched between the partially completed terminals, and the old 1½-in. wire-rope which had served to carry the lighter loads was used for lowering the running-block, in place of the manila rope.

The site of the bottom or sea-anchorage being at low-water of spring tides, only during two or three of the best spring-tides could access be had for excavation, and then only after a concrete dam had been put in across a gully which was about 2 ft. below low-water of spring-tides. At the best, only about 1½ hours' work could be secured at each tide, and all excavation had to be carried on by hand, as blasting increased the flow of water into the hole through the fissures in the chalk. When the pit had been sunk to a depth of about 4 ft., the volume of water coming in was so great that ten men were insufficient to cope with it by hand pumps and baling. Search was made in the gulleys for the entrance to the fissures, and by means of clay, loose and in bags, these were sufficiently choked to enable the excavation to be carried down to a depth of about 7 ft.

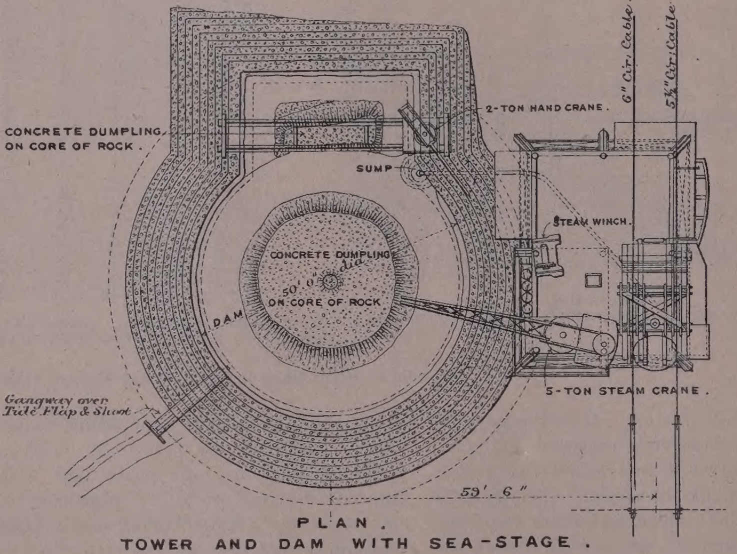
It was originally intended to construct this anchorage as shown by dotted lines in the illustrations, but the design was modified in order to avoid sinking deeper into the rock. The anchorage consisted of two built-up box-girders, each formed of a pair of rolled-steel joists, 12x6-in., braced together with steel plates. These box-girders were placed on end, 8 ft. from each other, in the hole excavated in the chalk, and were connected transversely by two steel channels, each 12x6-in. A flat steel tension-bar, 7x1¼-in., was passed through and secured behind each box-girder, connecting them with a pair of heavy cast-iron brackets bolted down at the rock surface. Pin-jointed flat steel tie-bars, 7x1¼-in., connected these brackets with the timber terminal on the deck of the sea-stage. Thus no bending-stresses came into play at the anchorage, under the effects of varying loads on the cableway.

The cableway consisted of two fixed steel-wire ropes, 6 and 5½ in. in circumference, having breaking strengths of 120 and 100 tons, respectively. These cables were secured at each end of the span by means of pin-and-thimble attachments. At the top end the anchorage consisted of a concrete block weighing about 96 tons, and the main cables were connected to this block through the medium of flat-bar ties laid over the top of the terminal frame, and steel wire-rope back-stays between the terminal and the anchorage-block. Steel girders were built in behind this block, and two pairs of steel bars, 2½ in. in diameter, were passed through the concrete block to connect each back-stay to the girders, tightening screws being provided at the end of the back-stay ropes.

At the bottom terminal the end of each cable was attached to a cast-iron saddle, free to slide upon inclined planed steel ways fixed to the timber terminal, to provide for elasticity and movement under varying loads. A 4-ton load would cause a sliding movement of about 1 inch. These saddles were connected to the flat-bar ties of the bottom anchorage, previously described, by means of yokes and a pair of screwed bars 2½-in. in diameter. When first erected these cables were stretched to a versed sine of 26 ft. for the heavier rope and 20 ft. for the 5½-in. rope; but later, with the view of facilitating the running of the loads, the cables were drawn tighter, to about 22 ft. and 18 ft., respectively.



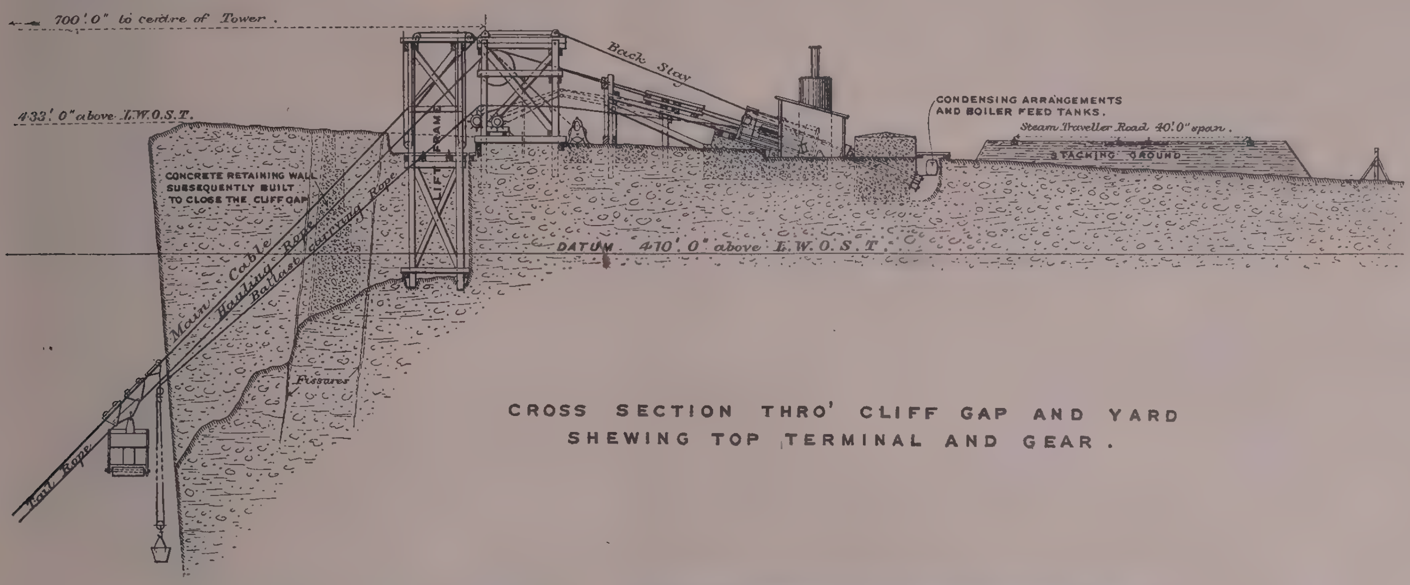
SECTIONAL ELEVATION.


6" Cir: Cable
5½" Cir: Cable
2-TON HAND CRANE.
CONCRETE DUMPLING ON CORE OF ROCK.
SUMP
STEAM WINCH.
CONCRETE DUMPLING 50'.0" dia ON CORE OF ROCK
DAM
Gangway over Tide Flap & Shoot
5-TON STEAM CRANE.
59'. 6"

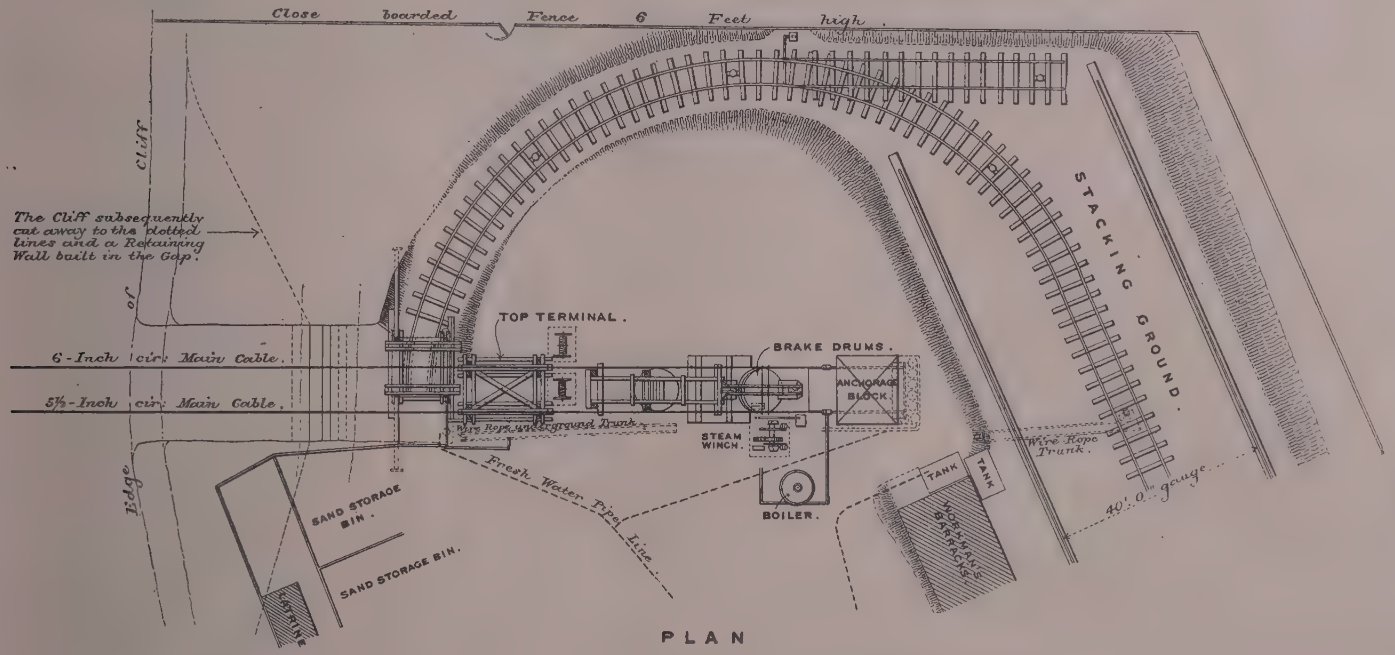
PLAN.
TOWER AND DAM WITH SEA-STAGE.

Diagram Showing Plant at Beachy Head Lighthouse.

The west, 6-in., cable was arranged for conveying the heavier loads, up to 5 tons, consisting principally of granite blocks, metal fittings, and machinery, the smaller east cable being intended to carry a cage containing a balancing-load, and also to convey workmen, stores, etc. The cage or load was suspended by means of a swivelling eye-bolt from the center of a compensating lever connecting two two-wheel carriers mounted on the cable. It was found that the lower wheel of each carrier became worn much more quickly than the other, and it was deemed advisable to transpose the wheels after the first year's working. The carriages or running heads of the two cables were connected for hauling purposes by means of an endless steel-wire rope 2⅞-in. in circumference, passed around brake drums and a tightening wheel at the top terminal, the two loads being thus balanced, one against the other. The endless haulage was completed by a tail rope 2 in. in circumference, passed over pulleys at the bottom terminal, connecting the two carriages on the lower side.


700' 0" to centre of Tower.
433' 0" above L.W.O.S.T.
Back Stay
CONDENSING ARRANGEMENTS AND BOILER FEED TANKS.
Steam Traveller Road 40' 0" span.
STACKING GROUND
CONCRETE RETAINING WALL SUBSEQUENTLY BUILT TO CLOSE THE CLIFF GAP
LIFT FRAME
Main Cable
Hauling Rope
Ballast Returning Rope
DATUM. 410' 0" above L.W.O.S.T.
Fissures
Tail Rope

CROSS SECTION THRO' CLIFF GAP AND YARD SHEWING TOP TERMINAL AND GEAR.



PLAN

PLAN OF TOP TERMINAL, CABLEWAY GEAR &c

Arrangement of Plant at Top of Cliff, Used in Building the Beachy Head Lighthouse.

It was originally intended to work this cableway by gravity alone, relying upon having a sufficiency of weights in the form of building materials, coal, water, etc., to be passed down to the sea-stage to bring back the returning cage and by supplementing these "paying loads" if necessary by loads of chalk or other ballast to be provided for the purpose, and thrown to waste at the bottom. For nearly two months this mode of procedure was adhered to, but it was found to be hardly a success, owing to a lack of sufficient available ballast to carry the cages down. It was, therefore, decided to employ steam haulage, and for this purpose a steam winch was installed at the top terminal to drive a horizontal shaft carrying a sliding bevel-pinion, gearing with a crown wheel on the underside of the rim of the lower brake drum. For descending loads, in order to obtain the advantage of the quicker speed for the first part of the run, the winch was thrown out of gear by sliding the pinion along the shaft. A descent by gravity and brake control, with a sufficient difference of load, could be made in about 40 seconds or less, whereas the return run by steam haulage occupied five minutes.

Tower Foundations.—Before the cableway had been completed, work was commenced upon the tower foundations by clearing away loose rocks, etc., from the site, and preparing it for the construction of the concrete tidal dam, as soon as the necessary materials could be lowered. The area enclosed was made as small as possible, room for the sump being arranged in the angle between the tower and the landing by splaying a corner of the dam. It was formed of 6-to-1 Portland cement concrete, with an inside vertical face, this face for the curved portions of the dam being built of stock bricks, roughly laid in alternate courses of headers and stretchers as the concrete was deposited. Its outside face around the curved portion was shuttered in 9-in. courses by means of strips of corrugated iron bent to the required curve. Short lengths of old iron pipes were set in each course of concrete to receive short iron bars for holding these strips by means of wood wedges, thus leaving no projections, and allowing the freshly deposited concrete at the close of each tide's work to be carefully covered with canvas and weighted with old iron cable chain. The portion of the dam surrounding the landing, being in straight lengths and of the same section, was shuttered both inside and outside with 9x3-in. planks, without brick facing. The top of the dam was 2 ft. in width and 8 ft. above low water of spring-tides.

A timber trunk was built through the dam at the level of the lowest point of the surrounding rock surface, with a tidal flap-valve outside; a gangway carried out from the top of the dam to a point directly over this valve enabled it to be opened or closed at will. The cast-iron 6-in. suction pipe from the sump to the 6-in. centrifugal pump was built through the dam at the level of the rock surface. When complete, the dam proved remarkably water tight, although a considerable quantity of water found its way into the excavation through fissures in the chalk at levels well below the cleaned surface on which the dam rested.

Prior to the completion of the cableway, ballast for making concrete was obtained five miles from the yard; but as soon as it was possible to do so, the cableway was utilized for procuring ballast from the foot of the cliffs. For this purpose a jockey-pulley was added in rear of the east carrier, free to travel with it up or down the cable, and under this pulley was suspended a grooved wheel. A 1½-in. flexible steel rope was passed over this grooved wheel and through a snatch block, one end of the rope being fixed at the top terminal and the other end at the suspended wheel. A turnover skip of ¾ cu. yd. capacity was attached to this snatch block, as shown in the drawings. As the vertical depth from the carrier to the foot of the cliff was almost exactly half the distance along the cable from that point to the sea-stage, it follows that the carrier, in descending from a point on the cable directly over the beach to the sea-stage, would convey a loaded skip, thus suspended, from the beach to the surface of the stage along an approximately horizontal line, and on being drawn back again, up the cableway, would return the empty skip to the original spot at the foot of the cliff. Two skips were used, one being filled on the beach while the other was being conveyed to the sea-stage, tipped and returned. By this method of collecting the material its cost was reduced from *7s. 2d.* to *3s. 6d.* per cu. yd.

A 6-in. centrifugal pump was used for emptying the dam and draining the foundations. It was bolted to the rock surface directly underneath the stage, and was driven by an Allen compound engine from the deck level by means of vertical shafting and bevel gear. As space on the stage was limited, the interior of the bottom terminal was utilized as an engine house, and steam for the engine was taken from the boiler of a 5-ton crane, through a pipe passing down through the center of the crane-post and under the stage deck.

The tower foundations are carried down 9 ft. 6 in. below low water of spring-tides, and 11 ft. below the average rock surface. A bore hole had been originally sunk on the site of the foundations to a depth of 53 ft., and had indicated hard chalk rock throughout. No blasting was permitted for fear of disturbing the surrounding ground, and all excavation was done by means of hammers and wedges. The diameter of the foundation courses of the tower is 47 ft., and the excavation was made 48 ft. 6 in. in diameter, the dam being 50 ft. in internal diameter. With a view to contracting the water space, the two foundation dumplings were built up with 6-to-1 concrete, in bags and in mass, to the level of the top of the dam, and as many of the granite stones of the foundation courses as could be conveniently stacked in the partially excavated area were lowered and closely packed there in order to displace water. The sump was then sunk below foundation level, and the excavation was confined to as small an area as possible by working around the circle in both directions from the sump. As soon as a sufficient area was "bottomed up" and made ready to receive a stone, this stone was set and the stones of succeeding courses were set on the lower ones, keeping as close up to the excavation as the scar ends would permit. The excavated space and the quantity of water to be dealt with were by this means kept as small as possible. When the courses had been brought up to the level of the top of the dam, the 9-in. annular space between the granite and the side of the excavation was filled in with 4-to-1 concrete, commencing at the side diametrically opposite to the sump and working in both directions back to the sump, which was finally filled in with 4-to-1 concrete.

As it had been found necessary to lay pipes from the worst of the several fissures to the sump in order to bed some of the stones of the foundation course, and as the quantity of the water draining to the sump at the most favorable time was sufficient to keep the 6-in. centrifugal pump running half of its time, it will be understood that some trouble was experienced in disconnecting, pulling out the rising main, and effectually filling the sump with concrete. This was done by choosing a very low spring tide for the purpose, and having enough concrete previously mixed and deposited on each side of the sump ready for throwing in; a canvas chute was used to pass the concrete through the rising water.

The granite stones forming the tower were quarried, cut, dressed and set up in the dry as twelve sections, about 10 ft. in height, the external joints being 3/16-in. in width, and internal joints ¼-in. These stones, after being numbered, were hauled from the nearest railway station to the workyard on Beachy Head by traction-engines. At the yard a stacking ground had been leveled and provided with a 5-ton steam Goliath crane of 40 ft. span, capable of traveling from end to end of the yard, and covering the whole area. As illustrating the force of the wind at times on Beachy Head, it may be mentioned that in March, 1900, this crane, while traveling with a 4½-ton stone was blown to the end of the yard and capsized, an attempt to stop it by means of the engine resulting in the stripping of the teeth of the gear wheels. The momentum of the superstructure and the suspended load of course helped to capsize the machine when brought up at the end of the road.

Masonry.—The setting of the tower masonry and the initial work of excavation and concreting were done by means of a centre-post hand crane. The centre-post or mast was double and telescopic, the outer part, 20 ft. in length and 16 in. in diameter, being capable of extension by means of the inner part to a total length of 35 ft. The two parts were secured together by means of cotter keys passing through slots spaced 12 in. apart. These cotters also served to hold wrought-iron rings, between which worked a trunnion ring carrying the foot of a jib 25 ft. in length; these rings, and with them the jib, were capable of being raised or lowered on the mast to suit the varying height of the work.

For setting the masonry of the landing on the north side of the base of the tower, a small 2-ton hand traveling crane was used, running on a framed road formed of a pair of baulks braced together, laid across and bolted to the top of the dam, from east to west. As the work grew above the top of the dam, this road frame, with the crane, was jacked up and carried on blocking from the work itself. When in position, it was held down to eye-bolts, let into the surrounding rock by means of chains and union screws. The road timbers overhung sufficiently at the east end to allow the crane to travel within reach of the jib of the stage crane for the transference of loads. When the tower had been built above the level of the solid lower portion, the center-posts of the setting crane were supported by six sets of radial timbers wedged from the granite walls of the several rooms without the use of bolts, and the well-hole below was thoroughly cleaned out and filled in solid from the rock upwards with 8-to-1 Portland cement concrete. To accommodate the setting crane to the reduced diameter of the tower courses as the work grew, the jib had been provided with a joint, allowing it to be shortened from 25 ft. to 16 ft. in length.

When the work had reached about 35 ft. above high water level it was no longer possible to transfer the loads from the stage crane to the tower setting crane directly, and other means had to be provided for feeding the work. A second and shorter jib was added to the center mast, free to turn and adjustable by means of rings and cotter-keys. A steam winch was fixed on the deck of the stage and provided with steam from the boiler of the stage crane. A wire-rope 3¼ in. in circumference was taken from this winch, through the window opening of a room, and, by means of guide pulleys, up the inside of the tower to a grooved pulley at the foot of the second jib, thence to the jib-head sheave and down outside the tower to receive from the jib of the stage crane. The load on reaching the required height was moved inboard and landed on a thick mat on the set masonry by derricking the jib. For the top two rooms, where the walls were thinner, when hoisting stones from below, a back-stay was arranged by means of a wire-rope from the setting-jib down through one of the lower windows on the west side of the tower. The center circular stone of each floor was hoisted and placed against the side wall before being shut in by the floor course of the next succeeding room, these stones being finally set in position after the center crane had been removed.

During the erection of the higher portion of the tower, advantage was taken of low water periods to remove the tidal dam and clear away and level the rock-surface within a diameter of 80 ft. This area was laid with an apron of granite pitching, 8 in. in thickness, finished off at its outer margin with a granite curbing, 18 in. in width and 2 ft. 6 in. in depth.

The first stone was laid in the foundations on Nov. 23, 1900; the level of the top of the dam was reached and pumping was discontinued by May 18, 1901; tide work was stopped on June 8, 1901; and the last stone of the gallery course was set on Feb. 25, 1902. The light was first exhibited on Oct. 2, 1902.

Electrolysis on the Metropolitan Water-Works.

There is probably no city in which electrolysis phenomena are being watched more carefully than in the district containing the mains of the Metropolitan Water and Sewerage Board of Massachusettts, and in the report of the chief engineer, Mr. F. P. Stearns, for last year some very interesting notes on the subject are given. Investigations relative to the injury to the pipes caused by electric current from the street railway systems were continued throughout the year. In the annual report for the year 1903 detailed descriptions were given of the injury done to 48-in. pipes in Cambridge, 24-in. pipes in Chelsea and 12-in. pipes in Lynn, and also of an experimental test of an insulating covering of asphalt and burlap which was being made by the Boston Elevated Railway Co. On April 6, 1904, this covering, which was applied in November, 1902, was removed from one length of 48-in. pipe for the purpose of examination. Before the covering was applied the pipe was carefully cleaned and the pits dug out and located. Upon removing the covering many new pits were found, and in some cases one large pit was found where there were two or three separate pits before the covering was put on. The number of pits in the pipe had increased from 80 in 1902 to 496 in 1904. The railway engineers suggested that possibly the pits were not all dug out before the pipe was covered, and therefore recovered it for a further test. They have since made the following experimental tests, which indicate that the covering has little if any value under some circumstances.

A short piece of 4-in. pipe, covered in the same manner as the large pipe, was buried in dry earth in a box, and a cast-iron plate was buried 1.25 ft. from the pipe. In one test tar was used in the covering, and in another asphaltum. The pipe and plate were connected in the regular trolley circuit of 500 volts. While the earth was dry the resistance between the pipe and the plate with the tar covering was 700 megohms, and with the asphaltum covering 34 megohms. The earth was then saturated with salt water, and the resistance quickly diminished, and after seven to ten days disappeared.

For the purpose of diminishing the injury which was being done to two lines of 36-in. pipe crossing under the Charles River near the power station of the Boston Elevated Railway Co. in Cambridge, two 48-in. insulating joints were set in July, 1904, one on either side of the river. Each of these joints was composed of two flanged pieces of 48-in. pipe, bolted together with a gasket of pure rubber ½ in. thick between the flanges. The bolts joining the flanges were covered with rubber tubing ⅛ in. thick, and the nuts were insulated from the casting by means of a washer of rubber ½ in. thick. The joints have a resistance of from 100 to 200 ohms when the pipe is filled with water, and are enclosed in waterproof chambers, to prevent the entrance of ground water.

These joints reduce the quantity of electricity leaving the 36-in. pipes in the river from 25 to less than 5 amperes, and reduce the quantity flowing along the pipes toward the power station from 65 to 40 amperes. The joints were expected to protect the pipes in the river at the expense, to some extent, of other portions of the pipe line; and the measurements of currents appear to show that the effect has been substantially as expected, as the quantity of electricity leaving the pipe between Western Ave., Brighton, and the river was increased about 25 amperes. As these joints reduced the quantity of electricity flowing along the pipe line, the railway company desired to set similar joints at other points, and late in the year an arrangement was made for the setting of four additional 48-in. joints. As the amount of current flowing along the pipes at different times depends upon the amount of power developed at these times at the different power stations, many observations are necessary to determine the average quantity flowing even for a single day, and these have not been taken since the last joints were installed; but enough measurements have been taken to warrant the statement that the introduction of the joint at one of the places has substantially stopped the flow of electricity along the pipe at that point. The conditions have been changed so as to increase the amount of electricity leaving the pipe north of the joint, but there appears to be at present not more than 40 amperes flowing along and leaving the pipe line, in place of 90 amperes; and there has also been a very marked reduction in the difference of potential between the pipes and the rails of the street railway company.

The measurements thus far taken appear to indicate that the effects of setting an insulating joint somewhere near the middle of a pipe line, one portion of which is electrically positive and another negative to the car tracks, are as follows: 1. To stop the direct flow of electricity along the pipe line at the point where the joint is set, and to reduce considerably the amount of electricity flowing along other parts of the pipe line. 2. To lower the average potential of the pipe line on the negative or power station side of the joint. 3. To raise the average potential of the pipe line on the positive side of the joint. 4. To maintain a difference of potential of several volts between the positive and negative sides of the joint, and to produce conditions tending to increase electrolytic action at that point, unless the joint is carefully located in dry ground. 5. To cause a new distribution of electrical conditions, under which the two sections of the pipe line become similar to the original line, with one portion of each positive and the other negative to the car tracks, so that the number of positive areas is increased by one for each joint.

Both in August and November, 1903, the attention of the officials of the Boston & Northern Street Railway Co. was called to the serious injury which had then been done to the Board's pipes, both in Chelsea and Lynn, by the currents of electricity returning to its power stations. Excavations made in November in Lynn showed that there were pittings in a 12-in. pipe 0.45 in. in depth, leaving only 0.25 in. of the original thickness of iron. As it was not deemed prudent to continue to risk the failure of this pipe line, it was relaid during the past year for a length of 593 ft. All of this pipe was laid in 1898, and when removed it was badly decomposed, and in several places very little of the original metal of the pipe remained. The officials of the railway company were notified that the pipes were to be relaid before the work was commenced, and were asked if they desired to adopt any preventive measures, but they did not do so; and on December 5, after the pipe was relaid, measurements showed that there were 20 amperes of electric current leaving the relaid section. It is probable that, if nothing is done to alter the conditions, it will be necessary to again relay these pipes not later than 1910.

The regular annual survey to determine the relative electrical potential of the Metropolitan pipe lines and the street railway tracks, and the amount of electricity flowing on the pipes at the several gaging stations, was made in April. In making these surveys voltmeter readings were made at each station every twelve seconds, for a period of five minutes. The figures are obtained from readings taken between 9 a. m. and 4 p. m. during the months of March and April, and do not represent the extreme results which would be obtained during the hours of maximum travel. The average of these readings, compared with similar readings made in 1903, shows that the electrical pressures have been generally reduced during the past year over the entire distribution system.

At a few points, however, the conditions are worse than in 1903. At one place in Brookline the voltage between the pipe and the rails has increased from 2½ to 5 volts, possibly due to increased traffic on the Boston & Worcester line. At a place in Milton the average voltage has increased from 18 volts in 1903 to 22 volts in 1904, and the maximum from 35 to 60 volts. This is due to poor track construction, and lack of return feeders on the Old Colony Street Railway Co. Early in the year the Boston & Northern Street Railway Co. was notified that there was a large difference of potential between the Board's pipes and their tracks in Stoneham, and that a large quantity of electricity was flowing along the pipe. During the past year the railway company has relaid the tracks and provided better returns for the current, so that the conditions have been greatly improved; but even now there is considerable current flowing along the pipe.

In January the attention of the Old Colony Street Railway Co. was called to the fact that a current of from 15 to 45 amperes had been measured flowing on a 12-in. pipe in Hyde Park, with differences of from 5 to 18 volts between the pipe and the rails. In June the pipe was uncovered at several points for examination, and pits about 1/16 in. in depth were found on several pipes. A service pipe of the Hyde Park Water Co. was found to be resting upon the 12-in. pipe, making an electric contact by means of which about 10 amperes of electricity passed from the Metropolitan main to the pipes of the Hyde Park Water Co. By raising the service pipe and breaking the electric connection, the flow of electricity along the pipes was reduced about one-half.

Oil Fuel is used at the central power station of the New Orleans drainage works, which supply current to a number of electric pumping plants. Sudden heavy rains make it necessary to start up rapidly and oil has proved more efficient than coal for the purpose.

Replacing a Four-Track Bridge under Heavy Traffic.

The four tracks of the New York Central & Hudson River R. R. cross the Erie Canal about two miles east of Newark, N. Y., on a skew through bridge about 163 ft. long. The original structure had been built at successive periods to accommodate the increasing number of tracks and consisted of three virtually independent spans, the center one having three trusses, marked 3-4-5 in the diagrams, carrying two tracks on a floor of transverse I-beams close together suspended from the bottom chords. The two outside tracks of the bridge were each carried on a pair of trusses, 1-2, and 6-7, one truss of each pair being set as close as possible to the outside truss of the center span. These tracks were carried on I-beam stringers web-connected to drop-end floorbeams seated on the riveted lower chords of the trusses. The old trusses were just deep enough to give train clearance for the shallow overhead transverse bracing and were made with a system of multiple intersection riveted diagonal members and with solid-plate portals, as indicated in the illustrations.

It was required to replace the old structure by a new one having three modern riveted Pratt trusses with subdivided panels and a single uniform floor system carrying two tracks between each pair of trusses, the change being made without material interruption to the passenger and freight traffic, without obstructing the canal and without closing more than one track at once except for very brief periods. This was accomplished by a slight lateral displacement of the old structure and the assembling of the new trusses successively between the old ones slightly above their required positions, then lowering them to grade, transferring the floor to them and removing the successive portions of the old structure after its service had been transferred to the new one. The old structure was required to sustain the additional load of each new truss until its completion and to carry the travelers by which the latter were assembled.

As the center lines of the new outside trusses are parallel to and only 1 ft. distant from the center lines of the corresponding old trusses, Nos. 1-7, it was necessary to provide clearance for their erection and the first operation was to move trusses 1 and 2 with their connected transverse members, forming a complete span, 2½ ft. laterally. Trusses 2, 3, 4 and 5, forming the center span, and trusses 6 and 7, forming the outside span over track 4, were also moved to correspond, leaving space beyond truss 7 for the new truss A. In order to support the latter while its members were being assembled a cantilevered floor was constructed with pairs of 85-lb. rails 30 ft. long, laid across the stringers between the ties under track 4, which was in service. The south ends of these rails were clamped to the lower chord of truss 6 and the north ends projected beyond truss 7, forming a series of cantilevers from 2 to 7 ft. apart. The double line of 8x16-in. longitudinal sills, 13 ft. long, breaking joints, was laid on them close to truss 7 and received the cambered blocks for new truss 8. Track 4 was closed to traffic and two stiff-leg derricks with 35-ft. booms and 10 tons capacity were seated on the top chords of the old trusses and erected new truss A. After this all the rails and the cantilever platform were removed and traffic was resumed on track 4.

In the second operation traffic was diverted from track 3 and a simple strident traveler was erected on the top chords of trusses 4 and 5 and rigged with tackles operated as the stiff-leg derricks had been, by a four-spool Mundy hoisting engine in a fixed location beyond the abutment. Track 3 was replaced by a narrow-gauge track located as close as possible to truss 5, on which material was delivered as required for truss B, which was erected close to truss 4 out of the required position, so as to allow clearance for the delivery of material. After truss B was swung and moved transversely to its required position between trusses 4 and 5, the traveler was transferred to a track laid on the top chords of trusses 1 and 2 and the stiff-leg derricks were set on the top chords of trusses A and B, as indicated in the diagram, and assembled between the top lateral bracing. Trusses 3, 4, 5, 6 and 7 were jacked up and trusses A and B were lowered to final positions, and the new standard trough floor was connected to their lower chords, and old trusses 6 and 7 were removed and the traffic for tracks 3 and 4 was carried entirely by the new trusses. Finally traffic was diverted from track 1 and materials were delivered on it for truss C, which was erected by the traveler. After it was swung, old trusses 1 and 2, with their floor systems, were removed, truss C was lowered to final position and the top laterals between it and truss B were assembled. Tracks 1 and 2 were temporarily raised and the permanent new trough floor was put in. Trusses 2, 3, 4 and 5 were removed by the derricks and traveler and the horizontal beams were cantilevered beyond the top chord of truss C to support truss 1 during its removal.

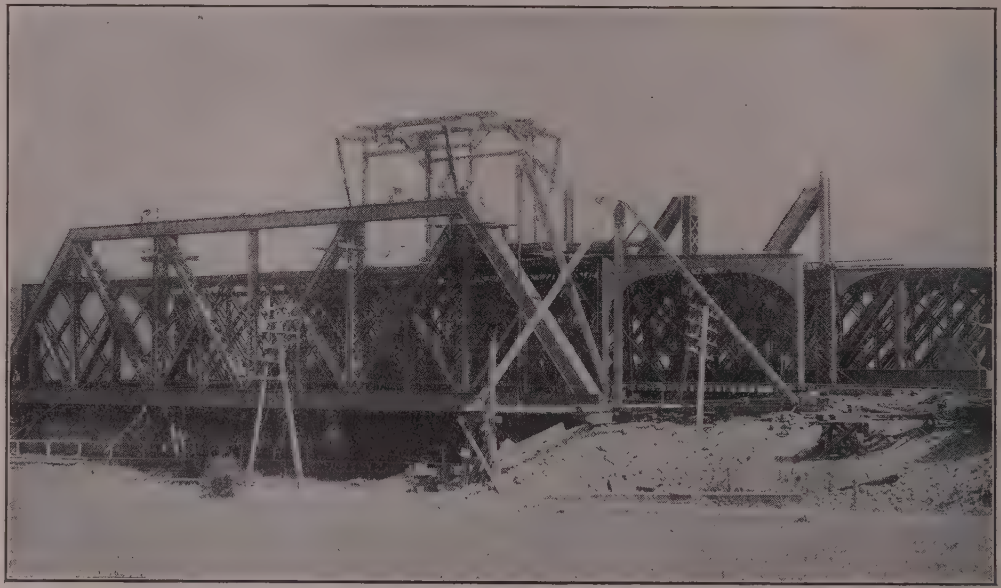
The bridge was designed under the direction of the engineering department of the New York Central & Hudson River R. R., Mr. H. Fernstrom, chief engineer; Mr. Olaf Hoff, engineer of structures, and Mr. A. E. Carpenter, engineer of bridges. The bridge was manufactured and erected by the Pennsylvania Steel Co., Mr. J. V. W. Reynders, superintendent of the bridge and construction department, and Mr. Fred W. Cohen, engineer of erection.

Long-Distance High-Tension Transmission in California.

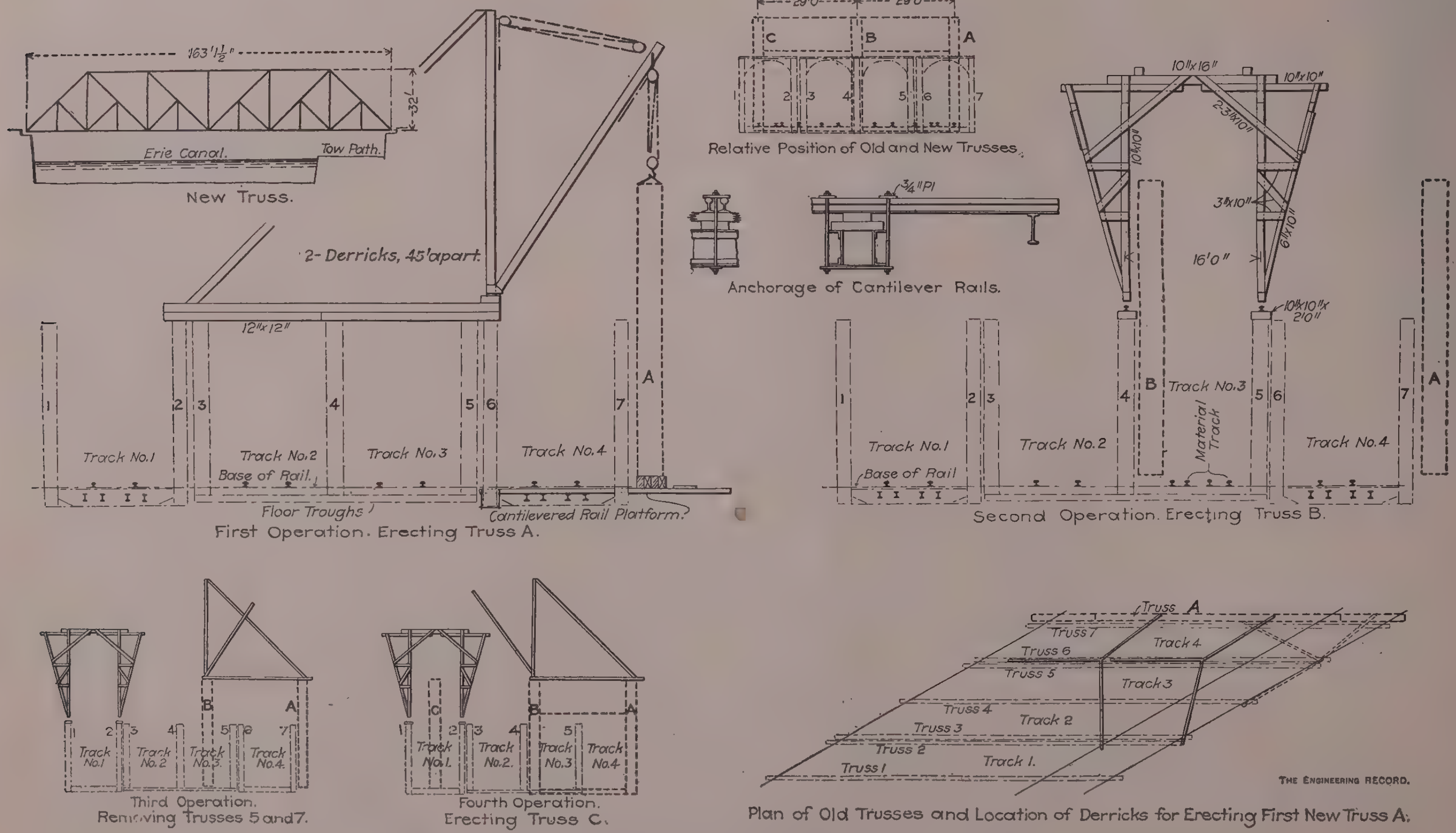
Abstract of a paper presented to the National Electric Light Association by John A. Britton.

The State of California is entitled to the credit for initial, original and pioneer work in long-distance electrical transmission, not only in the actual operative length of lines, but also in the high pressures used in such transmission. The progress made by the financiers and engineers in this State, during the past ten years, has been so phenomenal as to attract world-wide attention, with the result that there is a constant stream of those interested, from all parts of the world, to the coast, to observe the original work being done. Not only is California concerned in its trials and triumphs in long-distance transmission, but it has been the pioneer in high-head hydraulic work, as developed for large units. A recitation of the developments of electric transmission in the State would occupy more time than your patience would admit of, but a brief resume of what has been accomplished in the past ten years, all now under the control of the California Gas & Electric Corporation, may not prove an uninteresting one.

In the year 1888 attention in the engineering world was attracted by the Folsom Water Power Co. determining to build a dam across the American River, near the town of Folsom, and to erect a power house some two and one-half miles south



Erection of New Truss B With Tower Traveler.



New Truss.

First Operation. Erecting Truss A.

Relative Position of Old and New Trusses.

Anchorage of Cantilever Rails.

Second Operation. Erecting Truss B.

Third Operation. Removing Trusses 5 and 7.

Fourth Operation. Erecting Truss C.

Plan of Old Trusses and Location of Derricks for Erecting First New Truss A.

Diagrams of Successive Operations in Replacing a Four-Track Bridge.

of the dam on the river, conveying water by a canal having a capacity of 40,000 miners' inches, to low-head turbine wheels, under a head of 65 ft. (See Eng. Rec. May 25, '95.) Four 750-kw. units were installed, generating current at 800 volts, stepping up to 10,000 volts, and conveying the current thus generated to the city of Sacramento, 22 miles distant. The promoters of this enterprise were discouraged by the inability at that time of engineers to guarantee that 10,000 volts could be safely carried that distance for commercial purposes. In 1895 this dream became a reality, and Sacramento City was supplied with current generated at Folsom. While the insulation provided gave more or less trouble initially, this was gradually overcome. In 1892 the late A. W. Decker, electrical engineer, acting for the San Antonio Light & Power Co., at Pomona, Cal., recommended the installation of electric equipment at the power plant of that company, to convey by means of step-up transformers a pressure of 10,000 volts over approximately 16 miles of line, to the city of Pomona. The generators as finally installed delivered single-phase current at a pressure of 500 volts, and the transformers were wound in the ratio of one to two. There were ten transformers in service on the primary, giving 10,000 volts with a capacity of 6 kw. each installed. Glass insulators were used upon this line.

In 1895 there was begun the construction of a water-power plant near Nevada City, in Nevada County, in the State of California, to transmit about 1,000 h.p. a distance of five miles, with generators wound direct for 5,000 volts. The water was conveyed from a dam on the South Yuba River through 3½ miles of flume, having a capacity of 8,500 cu. ft. per minute, and delivered to a 42-in. pipe, 286 ft. long, with a head of 190 ft. There were installed at that time two 330-kw. units.

Erection of New Truss A-on Cantilever Rail Platform in Replacing Four-Track Bridge.

From these small beginnings has grown a system throughout the State, aggregating in generator capacity at present installed, over 50,000 kw., and units of 5,000 kw. with varying heads up to 1,530 ft. In the central part of the State, utilizing the waters of the western slope of the Sierra Nevada Mountains, there are at the present time, in continuous operation, 577 miles of ditches, 25 5 miles of flumes, operating 14 water-power plants, having installed 41 generators, with a rated capacity of 50,790 kw., and having a water storage in numerous lakes aggregating over 3,000,000,000 cu. ft., or 1,500,000 miners' inches for 24 hours. From these power houses there are in continuous service 715 miles of pole line and 734 miles of circuit operated at 50,000 to 60,000 volts, and 479 miles of circuit at voltages varying from 10,000 to 50,000, and 90 miles at lesser voltages, not including any local distribution. Power is delivered to 94 substations, with 75,000 kw. in transformer capacity installed, scattered over 21 counties and 33 cities in the State, representing a population of over 60 per cent. of the entire State of California, and covering an area of 15,000 square miles. This power is regularly transmitted 232 miles, and by reason of certain conditions at times existing at the different power plants necessitating the transmission over all lines from one power plant, has been successfully operated 325 miles at 55,000 volts.

In addition to the transmission of power, it may be interesting to know that the high-pressure wires supply 1,961 miles of distribution wires in service, from 2,300 to 5,000 volts, and serve approximately 20,000 consumers for lighting, and motors of 100 h.p. and less, totaling 40,000 h.p.

In no other portion of the globe where long-distance transmission under extreme high potential has been used, do climatic conditions exist similar to those in California, and this must be particularly borne in mind when considering the work that has been done, the problems solved, and the successful conclusions arrived at in the determination that there is no limit, except that of the earning capacity on capital, to the carrying of current over wires to any distance.

As above stated, power is obtained from the waters flowing from the west slope of the Sierra Nevada Mountains. These mountains are snow-capped the year round, and some of the power houses are within the snow belt, which exists during the winter season. Following down the mountain sides, these pole lines emerge into the vast Sacramento and San Joaquin valleys, which extend from Sierra County on the north to Kern County on the south, a distance of approximately 350 miles, and will average about 60 miles in width. After leaving the valleys, the pole lines cross the Coast Range, lying between the valleys and the Pacific Ocean, and generally follow the contour of the bays of San Francisco, San Pablo and Suisun, until they reach the commercial centers of distribution. In this long distance traversed, they are subjected to extreme climatic conditions—from the colds and frosts of the mountains to the severe heat of the valleys, and to the cooling, fog-laden winds from the ocean.

The first transmission line to reach the bay shore was that of the Bay Counties Power Co., carrying current generated at Colgate on the Yuba River, about 28 miles northeast of the city of Marysville. This line was started at 44,000 volts, which voltage has since been raised to 55,000. The construction of the line was of round cedar poles, from the State of Oregon, an average height of 50 ft., and the character of construction substantially that now in use, but with a less separation in some instances than was subsequently found necessary. The very many alterations of plans from time to time, as different conditions obtained, to insure service, need not be here recapitulated. The greatest difficulty encountered in the carrying of the high potential was in and about the bays mentioned, due to the heavy salt fogs that for certain periods of the year hang densely over the land, sometimes lasting for days. In these particular districts the insulation has broken down at most unexpected places, causing the burning off of poles, and shortening the line. The new four-part insulator with iron pins has entirely overcome this defect, and for the past season, under the most trying circumstances, no trouble has occurred, the number of hours of shutdowns upon all of these lines being of a negligible quantity.

In addition to the conditions named of transmission over and through countries of varying temperatures, it must be remembered that for seven months of the year, extending usually from April until the first of November, no rain falls within the district named, and where the pole lines run along or adjacent to the public highways, where heavy teaming for all purposes is carried on, they are covered with a fine dust, which arises from traffic, and are subjected at times to extremely hot north winds. For the remaining five months of the year the lines are subjected from time to time to heavy rains and to the high winds accompanying the winter storms. Bearing all these facts in mind, it is nothing short of remarkable that within a period of not over four years such wonderful results have been obtained in transmitting current over the distances involved; for the establishment of the Colgate plant, and the carrying of current into the city of Oakland, its initial distributing point, occurred in the year 1901.

One of the greatest engineering feats ever accomplished, and one that has never received from the engineering world the attention which it deserves, was the construction, in 1901, of the famous Carquinez span of four steel cables, suspended from steel towers (see Eng. Rec. June 22, '01). This span crosses the Carquinez Straits, connecting San Pablo and Suisun Bays, and is 4,427 ft. in length between towers, having at its maximum point of dip an elevation of 206 ft. above high-water line. The maximum sag of the wire between the two steel towers on the north and south sides of the straits is 257 ft. The main tower, in Solano County, on the north side of the straits, is 224 ft. in height, and the bluff at the point of construction is 162 ft. above tide water; on the south side the tower is 64 ft. in height, and the bluff 400 ft. above tide water. It is interesting to note that this crossing has given absolutely no trouble in operation. Both of the towers mentioned are used for distributing stations to the different manufacturing cities along the bay shore, besides serving as general switching stations.

In the ordinary construction spans up to 1,800 ft. in length are constructed in the mountains across deep ravines, using ordinary 40-ft. round cedar poles for this purpose.

Experience has demonstrated that the form of lightning arrester which gives good service at low voltage is absolutely useless on high-tension lines. While these were first installed, they have since in every case been abandoned. At the present time nothing is used but the Horn gap arrester. As the voltage of the lines has been raised, and the insulation increased, the damage due to lightning is steadily decreasing. It is well to state that beyond the line of the foothills of the Sierra Nevada Mountains, lightning rarely occurs; possibly once a year throughout the Sacramento and San Joaquin Valleys and along the bay shore are there any discharges of lightning that would be detrimental to the lines.

The first construction of lines in this State was 40 to 50 poles to the mile, insulators being used at a maximum cost of 15 cents. All new lines are now being constructed on the basis of 20 poles to the mile, and four-part insulators are being used, costing approximately $2 each, and weighing about 30 lb. These are the outcome of months of patient work and experiment by the engineers on the Pacific Coast.

Much work has been done in designing and carrying out the construction of outdoor switches. Experiments have been continuous along the lines of oil switches, and experience has demonstrated sufficiently that this switch as at present constructed is entirely satisfactory and will handle heavy currents under high pressures. Double-break and quadruple-break oil switches are now being made, the latter being used for very heavy service in the large power houses.

Other than the line heretofore mentioned, conveying power from Colgate to the Bay of San Francisco, the line of the Standard Electric Company to the power plant at Electra, on the Mokelumne River, a distance of 142 miles from San Francisco, is an illustration of the possibilities of the increase of the efficiency of the line by high insulation. When first constructed, this line was operated at 33,000 volts, which potential was maintained until March, 1904, when steps were taken to operate it in parallel with the other lines controlled by the California Gas & Electric Corporation, the Bay Counties and the Valley Counties companies, and it was at that time increased to 55,000, and has been so operated ever since. The type of insulators in use in March, 1904, has been substituted for the four-part type, in such sections of the territory of the Standard as by reason of climatic conditions called for a higher insulation.

Outside of the immediate fog belt mentioned, the two and three-part types of insulators have been found extremely efficient for voltages up to 60,000, and experiments have been made to demonstrate that they will safely carry 80,000 volts without breaking down.

The progress made in the engineering and construction work of power houses has kept pace with the progress in pole line work, and insulating and switching devices. The first installation made at Electra, in 1899, of five 2,000-kw. units, called for a floor space equal to 1.16 sq. ft. per kilowatt; the Colgate installation made in 1897, of 9,400 kw., called for 0.98 sq. ft. per kilowatt; the recent installation at the de Sabla power house of the Valley Counties Power Co., of 9,000 kw., called for but 0.4 sq. ft. per kilowatt. The installation now being made at Electra of two 5,000-kw. units, calls for but 0.288 sq. ft. per kilowatt. The areas given include room for transformers, switches, and so forth.

It will be noted that the first installation at Electra required four times the floor space per kilowatt as compared with the work at present being done, and illustrates more clearly than words can convey the advancement in the past six years. It is believed that the floor area in the new Electra installation is less than that of any other power plant in existence to-day. In these plants there is no crowding of apparatus, and there is ample room for all operation or repairs, and in future work it will be safe to assume that this minimum of floor space can be still further reduced. Reduced floor area means, of course, reduced operating expenses, as well as reduced cost of construction.

When it is considered that the operation of these power plants extends to an infinity of uses, from the moving of street cars to the operation of sewing machines, from factories using ponderous machinery and exacting conditions of demand to the most minute uses to which electricity can be applied, and that during the four years of active operation on this coast new contracts are continually being made for the use of electricity against the installation of steam plants that might be operated with the cheapest fuel known (which is California oil at between 55 and 60 cents per barrel of 42 gallons), it is a tribute to the knowledge, perseverance and energy of the engineers that such work has been accomplished and so perfectly done in so short a space of time. Motors as large as 800 h.p. come on and off the line unnoticed.

From the point in the mountain stream where the diverting dam arrests the onward flow of the water through the ditches constructed upon the sides of the chasms, the flumes across deep canyons, to the utilization of such water at the water wheel, and then over the lines by which the invisible current is conveyed over the many miles of copper and aluminum wires to points of distribution, there is exercised a watchfulness and care that is unceasing. Constant lines of patrol are maintained at the reservoirs, on the flumes and ditches, and along the pole lines, and direct telephone connection is made by the patrolmen, over private telephone lines, to the central power houses. By the construction of the double-pole line from the main power houses to the bay, constant service is insured, because it is but the work of a moment to switch the high potentials, by means of the switches illustrated, from one line to the other.

Experience with aluminum wire along the bay shores has demonstrated that it is impervious to the action of the atmosphere heavily laden with salt, and quite as effective in that regard as the copper.

Cement Fence Posts.

Although the cement fence post is not economical compared with well painted wood and steel in most parts of the country, it is attracting considerable attention and finding some use. Probably one reason for this is the deep-rooted prejudice of the average farmer against the use of paint, which he regards as a costly adornment rather than the very useful preservative that it is. Unprotected wood or steel posts are at a disadvantage in comparison with concrete posts, and so long as they remain unprotected the use of cement for this purpose will continue. At the present time the main question in constructing cement posts is their reinforcement, according to Mr. H. A. Law, of Lake City, Iowa, who has found that a wire in each corner within half an inch of the surfaces gives the most satisfactory results.

The tamped or dry process of molding the posts has never been successful, he says, in posts when compared with the wet process product. The latter uses less cement and makes a denser post. The tamped post is more subject to the action of the elements, and water penetrating it readily makes it an excellent prey for frost. The wet process post has a glaze on the surface that makes it nearly impervious. Furthermore, there can be no accurate placing of the reinforcing wires with the tamped post, for the reason that the tamper will displace the wire, and the concrete will not form around and unite with the wire nor allow the wire to stretch as it will when wet enough to pour.

The concrete for the post should have plenty of gravel in it, thus using less cement and securing a stronger post. It can be made five parts of gravel and sand to one of cement, or even six to one, but it is preferable to make it four to one, Mr. Law states. The dry materials should be thoroughly and carefully mixed, and then the slush should be turned many times.

Many inventors and experimenters with concrete posts have lost sight of the fact that the posts are useless to the farmer unless fencing can be readily and easily fastened to it. All fasteners where the post is bound solidly to the wires are failures. Manufacturers of woven fencing, which is the principal fencing used to-day, always direct that the staple in the wooden post is not to be struck the last blow; that is, that the fencing is to be left free to expand and contract with the change in temperature without being bound to the posts. Therefore, pieces of wire embedded in the post to be twisted about the fence wire, or two projecting wires to be twisted about the fabric are not successful. It has been found that two staples set parallel and horizontally, to allow the fence wire to pass between them, and having a short key wire between them, leaving the fence free to expand and contract, although perfectly fastened to the post, are the best fasteners. These staples made of heavy wire, thoroughly galvanized, will last indefinitely, in the opinion of wire experts.

The molds for the posts should be made of wood with metal ends. These molds should be in five parts; that is, two sides, bottom and two ends, and not fastened together. The face of the post should be in the bottom of the mold and the places for the fasteners should be sunken in the surface of the bottom of the mold, thus making all posts uniform as regards the placing of the fasteners. Iron molds are far too heavy and expensive to be practical, while wooden molds are light and with care will last a long time, and when they are used up they are cheaply replaced. It is preferable to have strips of molding in the forms to make the posts without a sharp edge, which is easily chipped off. The line post molds should be at least large enough to make a post with a 3x3-in. top, 4x4-in. base and 6½ ft. long. The corner should be 5x5-in. top, 6x6-in. base and 8 ft. long and have lugs to place the brace posts under. These brace posts should be 4x4-in. and 8 ft. long and next to the corner a heavy intermediate post is advisable.

The posts being molded and set are ready for the curing, which should be done in the manner of other concrete products, keeping them well sprinkled. The posts can be used in thirty or even twenty days after they are made, but it is advisable, in Mr. Law's judgment, to keep them at least 60 days previous to setting out. The posts, being made of true concrete, during exposure to the weather, grow constantly harder and better. Mr. Law has observed posts that have been allowed to freeze in a river and thaw out that apparently were as strong or stronger than before.

The New Turbine Steamer, Viking, recently completed for summer excursion traffic between Liverpool and the Isle of Man, has proved to be one of the fastest passenger vessels afloat. Carrying the equivalent of a full passenger load, she ran continuously at full speed for 5 hr. 40 min. at an average speed of 23.53 knots. The first half of the run was at the rate of 23.68 knots, and while returning she touched 24 knots for some distance. She is equipped with three sets of Parsons turbines, each driving an independent propeller; the two outside turbines are low-pressure and fitted with reverse blades for backing at 15 knots.

Steel Details of the Wanamaker Power House, Philadelphia.—II.

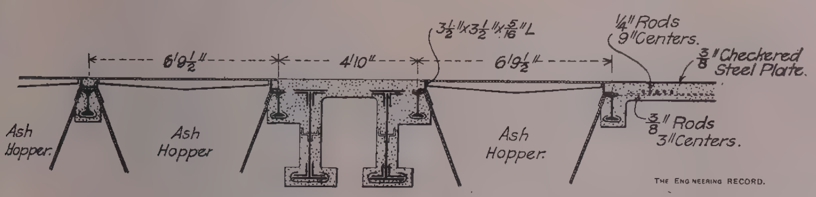
The boiler room floor has special framing corresponding to that shown in the diagram of an intermediate panel, and symmetrical about the center line of the building except for the differences due to the eccentricity of the row of interior columns and the different lengths of the panels between the columns. This floor is designed to be occupied exclusively by eight Babcock & Wilcox boilers of 663 h.p. each, which, with their settings, have total weights of 460,000 lb. each. The construction is a system of longitudinal and transverse plate girders with I-beams, mostly 12 and 15-in. deep, bracketed or web connected parallel to them and with I-beams 18-in., 20-in. and 24-in. deep, supporting the walls, except in some panels where 24-in., 30-in. and 39-in. plate girders are used.

The floor is made throughout of reinforced concrete flat slabs and arches and the concrete is extended to enclose and fireproof all the floorbeams and girders. Under the boilers it is made special, as shown in the section detail, and covered with asbestos and brick. In the center aisle, between the boilers, the concrete floor slabs are covered with thin checkered cast-iron plates to give a better foothold, and openings in it over the ash hoppers, are covered with removable cast-iron checkered plates stiffened with ribs on the under side. Under the boiler room floor at one end of the building, two platforms are suspended from the floor girders. They have solid beam and concrete floors with a capacity of 22,000 lb. each, and are designed to support the boiler blow-off tanks.

The floor next above the boiler floor carries eight fans manufactured by the American Blower Co., and supports a 650-ton coal bin and a 75-ton ash bin. There are four forced draught fans, each with a capacity of 27,000 cu. ft. of air per minute at a temperature of 80 degrees Fahr., and four induced draught fans, each with a capacity of 51,000 cu. ft. of air per minute at 550 degrees Fahr. The induced draught fans are each operated by a 50-h.p. center crank, vertical enclosed type engine made by the American Blower Co. Each forced draught fan is operated by a 40-h.p. Crocker-Wheeler electric motor.

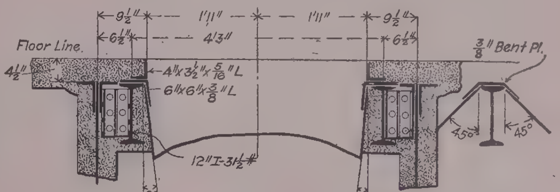
The framing of this floor is simple, and besides the wall girders corresponding with those in lower stories, consists of lines of transverse plate girders connecting the intermediate columns, longitudinal 18 and 20-in. I-beams about 3 ft. apart under the coal bin and ash bin in the center of the building, and 12 and 15-in. transverse I-beams on both sides of the building carrying the outside floor and the fans. The coal bin is 61 ft. long, 28½ ft. wide and 12 ft. high over all above the floor. Its horizontal floor is made with a 4½-in. continuous slab of reinforced concrete, which is supported on the 20-in. I-beams, that are also enclosed with a fireproofing of concrete. Pyramidal steel plate hoppers are set on the center line of the floor, as indicated by dotted lines in the plan, and deliver through chutes to the boiler room floor.

This arrangement of flat bottom makes it necessary to shovel the last of the coal into the hoppers if it is desired to entirely empty the bin, a contingency which is not likely to happen often, and it gives a considerably increased storage capacity and reduces the cost of construction. The vertical walls are made with vertical 9-in. I-beams about 4 ft. apart, seated on the top flanges of the floor beams and girders and connected at



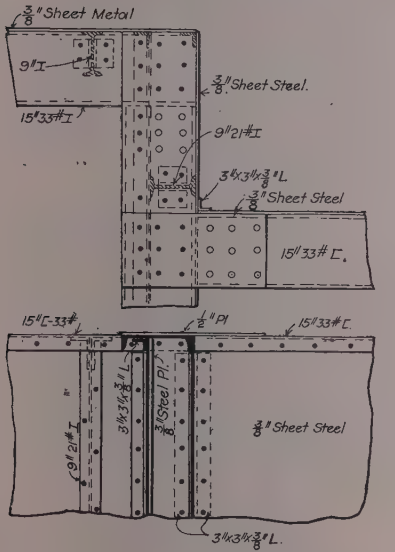
THE ENGINEERING RECORD.

Enlarged Section through Ash Hopper on Line Z-Z



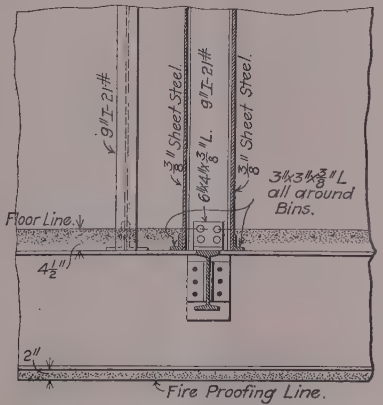
THE ENGINEERING RECORD.

Detail of Coal Hopper Connections.



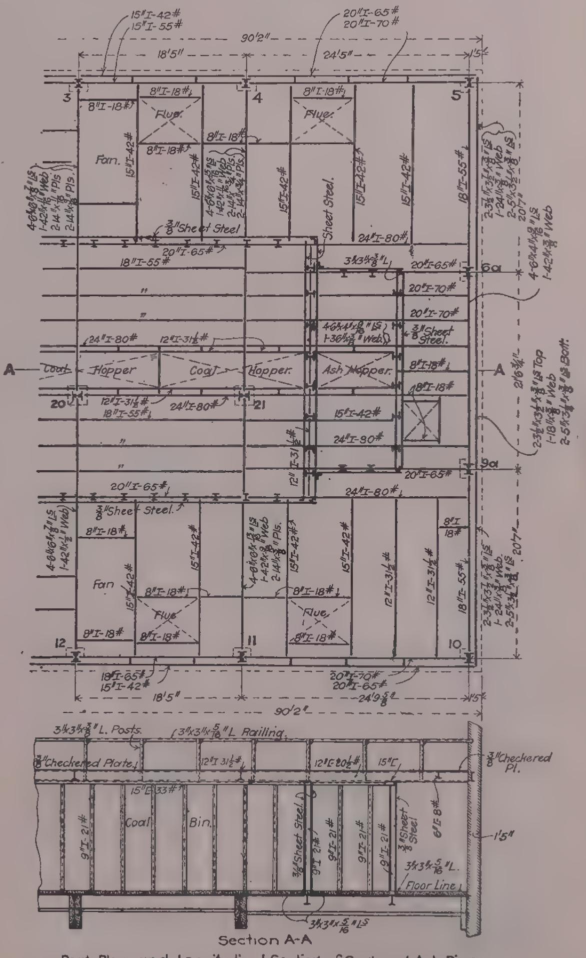
Corner Detail of Bin Top.

THE ENGINEERING RECORD.



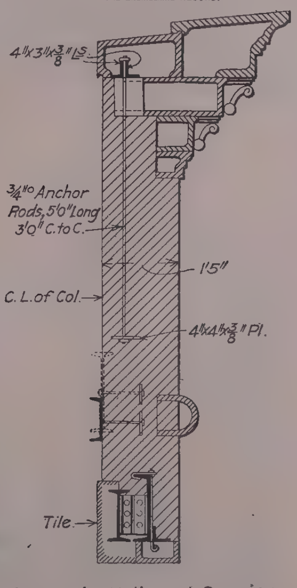
Detail of Bottom Connections of Bins.

THE ENGINEERING RECORD.



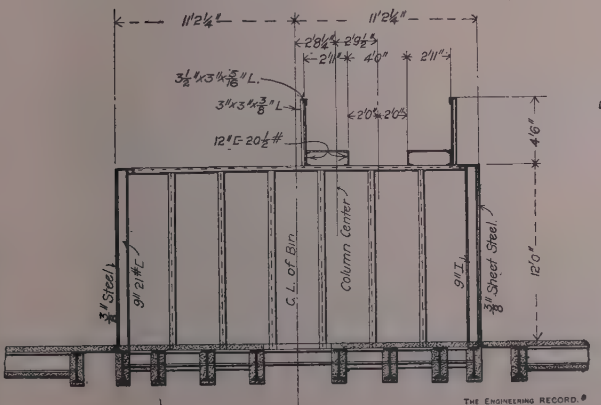
Part Plan and Longitudinal Section of Coal and Ash Bins.

THE ENGINEERING RECORD



Parapet Wall and Cornice.

THE ENGINEERING RECORD.



THE ENGINEERING RECORD.

End View of Bin

Details and General Arrangement of Ash and Coal Bins in the Wanamaker Power House.

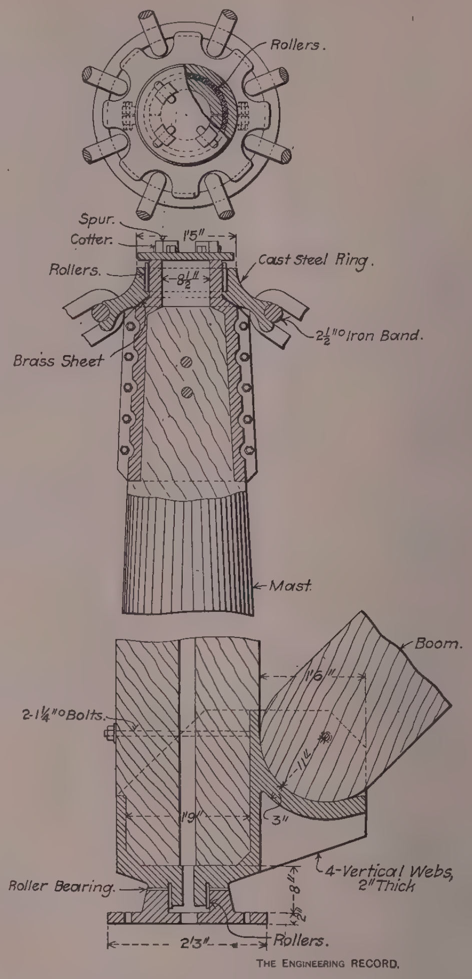
their upper ends to the horizontal webs of 15-in. 33-lb. channels, flanges down, which form a rectangle in the plane of the top of the bin. Continuous ⅜-in. steel plates are riveted to the outer flanges of the 9-in. I-beams and without any concrete filling form the sides of the bin. Lateral pressure is resisted by three intermediate horizontal transverse 12-in. I-beams, which connect the upper edges of the longitudinal sides of the bin.

At one end of the bin the wall is made double by riveting ⅜-in. plates on both flanges of the 9-in. I-beams, and forms a partition between the coal bin and a 9x22½-ft. extension, which is of the same construction, and is used for storing ashes. Both coal and ashes are delivered to the bins by a Link Belt Machinery Co.'s traveling, bucket type conveyor, driven by a 25-h.p. electric motor. The conveyor and a 3-ft. walk on each side of it are carried over the top of the bins on four lines of longitudinal 12-in. channels, web-connected to the transverse I-beams. Outside the bins the floor of reinforced concrete, covered with mosaic tile, is proportioned for a total dead and live load of 300 lb. per square foot.

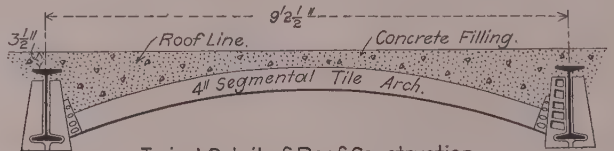
The story above the coal and ash bins is the uppermost one, and in it is installed the refrigerating plant. The floor is proportioned to carry in certain positions the pumps and large tank and elsewhere has a capacity of 250 lb. per sq. ft. total dead and live load. There are three lines of transverse plate girders connecting the intermediate columns and both longitudinal and transverse plate girders in the four center panels carry the beam framing around the openings left for the stacks and by-passes. These girders and I-beam wall-girders, like those in lower floors, support the web-connected I-beams carrying the concrete slabs. These beams are from about 3 to 4 ft. apart, and their depth varies with the length and loading, being a maximum of 24 in. for one 34-ft. panel.

In this story the mosaic tiles are omitted on the concrete floor around the stacks, and in other places, outside the refrigerating rooms, are replaced by wood. There are in this floor eight circular openings about 6½ ft. in diameter for the four stacks and their by-passes. Each is framed with a circular 10-in. channel bracketed to the center points of 45 degree corner beams, which make up the octagonal outlines of the floor panels. The circular channels have vertical webs with their backs just clearing the steel shells of the stacks and support bearing angle rings riveted to the latter. The stacks are 54 ft. 10 in. high above the refrigerator room floor, and the shells are made up of 6-ft. courses spliced together with outside sleeves.

The flat roof is pitched about 1:25 from a longitudinal line near the center to both sides. There are two lines of longitudinal I-beams, 20-in. deep in the longest panel, and 15-in. deep elsewhere, which are connected, one line to the intermediate columns and the other line about 7 ft. away, parallel with them. To these beams and to wall beams of the same depths are framed 15-in. and 24-in. transverse I-beams from about 7 to 9 ft. apart. Three monitor skylights about 13 ft. long, with vertical walls, steep pitched roofs and steel frames, are seated on the longitudinal beams, and openings are framed on each side of the roof for one larger similar skylight and two stacks, the latter corresponding to those in the refrigerator floor. In other respects the roof con-

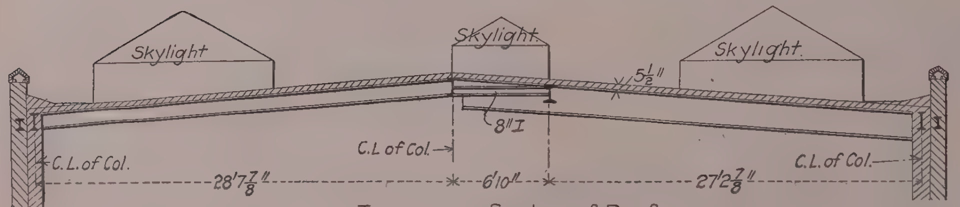


Special Fittings for Mast of 40-Ton Guyed Derrick



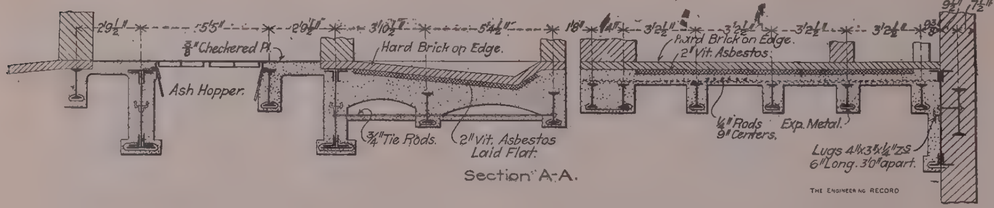
Typical Detail of Roof Construction.

THE ENGINEERING RECORD.



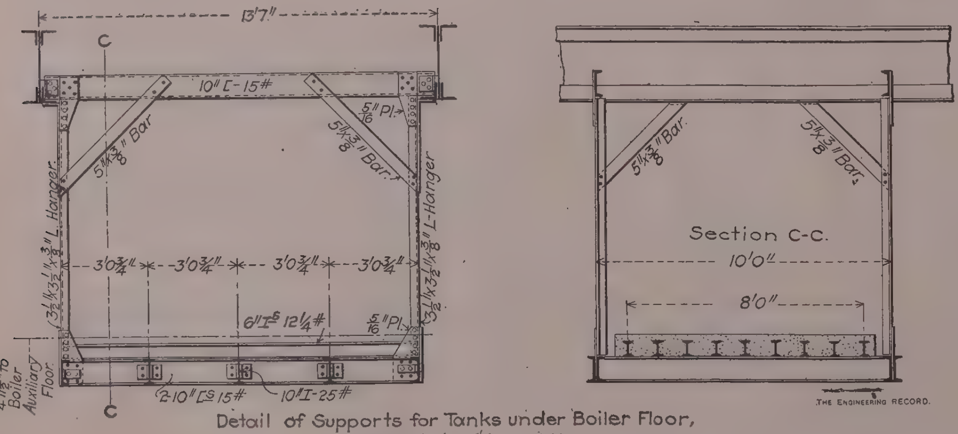
Transverse Section of Roof.

THE ENGINEERING RECORD.



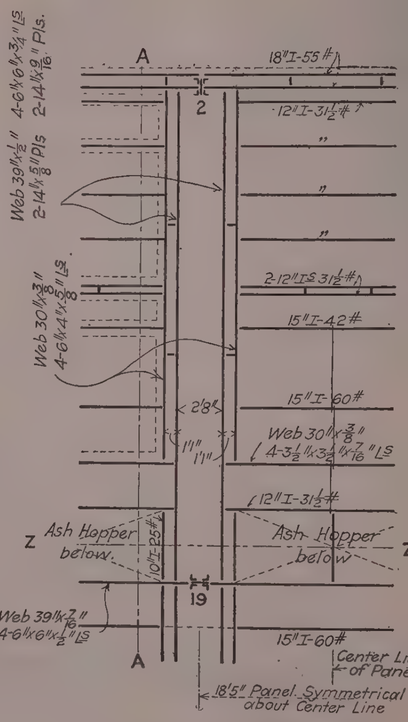
Section A-A.

THE ENGINEERING RECORD



THE ENGINEERING RECORD.

Detail of Supports for Tanks under Boiler Floor, near Col's. 4 and 11.



Boiler Room Floor Framing.

THE ENGINEERING RECORD.

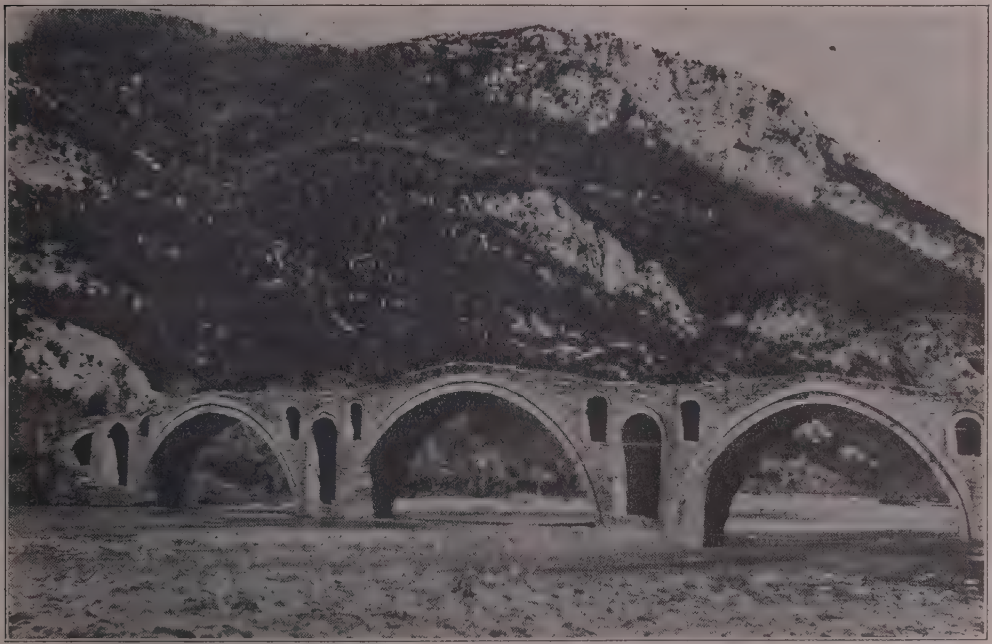
Details of the Roof and Framing of the Wanamaker Power House.

struction is regular and the transverse beams support, on their lower flanges and webs, the skewbacks for segmental arches of 4-in. tiles. These have a rise of 11 in. and are leveled up with cinder concrete to a depth of 3½ in. above the tops of the I-beams. They are calculated to carry a load of 30 lb. per sq. ft. besides their own weight.

The brick outer walls extend about 7 ft. above the lowest part of the roof beams, and are carried on wall beams like those in the lower tiers, but of smaller depths. On the street front the wall is capped with a projecting cornice of four courses of hollow terra cotta blocks, which are anchored to the brickwork by vertical rods built into the latter and engaging pairs of horizontal reaction angles, which are continuous through the cornice, as indicated in the cross-section.

The structural steel weighs about 3,460,000 lb. The building contains about 3,000 cu. yd. of hand mixed concrete, made with Vulcanite Portland cement.

The power house has its 66-ft. front on Ludlow street, and is bounded on the two long sides by 7 and 8-story buildings, and on the rear by other buildings which enclose it about one-third of the way from each corner, leaving a 25-ft. alley 100 ft. long, open to Market street. Ludlow street, in front of the building, was entirely occupied by the pipe tunnel, which had been built previously in readiness for the power house, but which, owing to changes, was exposed so as to completely obstruct the street and shut off material deliveries from this side. The site thus resembled a bottle with a 25x30-ft. neck through which the very long and heavy members had to be delivered on wagons. When the wagon was part way through the alley the horses were taken off and it was pulled on to the end of the alley by the hoisting engine which operated the derrick.



An Old Masonry Bridge over the Drin River in Western Turkey.

A chain sling was hitched to the column or girder and pulled it longitudinally and horizontally until it was free of the alley and then released it and picked it up with another hitch and swung it to position. It was at first proposed to rivet up the triple-web 66 ft. cantilever foundation girders complete at the shops, thus making 81 ton members to be handled in the narrow alley and swung in inclined positions to pass through the narrow clearances to their locations. This plan was reconsidered and each girder was shipped in three full-length pieces, and assembled in position by the derricks. The transverse diaphragms were bolted, where it was impossible to drive the field rivets, by special ratchet wrenches devised by the superintendent.

The soil was an excellent quality of fine and coarse gravel in layers, and was excavated by hand to a maximum depth of nearly 40 ft. below the curb. Ground water was encountered at about 36 ft. below the curb and was removed by sinking a large central sump more than 40 ft. deep, and installing there one Worthington and one Riley pump, each with a 6-in. discharge and operated by General Electric motors, which were also used to operate the Lidgerwood hoisting engines used for the derricks. The adjacent buildings were underpinned before the excavation was made.

The shape and dimensions of the lot were unfavorable for the erection of the steel work, being too large to be commanded by one derrick and too small to afford full scope for two derricks. Two special 40-ton guyed derricks, with 65-ft. booms were installed, one near the end of the alley and the other near the opposite end of the lot, both approximately on the longitudinal axis of the building. These were each guyed with eight 1¼-in. steel ropes, and were not moved except to be raised to every second tier of beams, an operation which was accomplished without putting them out of service but a very short time. They set column sections 69 ft. long, which weighed 28 tons each, and were handled by chain slings made with 1½-in. steel links, tested to 38 tons.

The derricks had 75-ft. masts tapered from 24 to 20-in. diameter and 65-ft. booms tapered from 20 to 18-in. diameter, both timbers being provided with special improved fittings which did not require them to be weakened by cutting and framing. The foot block was an octagonal steel socket casting with a concave seat for the butt of the boom. The bottom was shouldered to engage the hole in the base and the shoulders were made with hardened steel rollers, the vertical ones being ½-in. cylinders, and the horizontal ones being slightly coned and about ¾-in. in diameter. This arrangement reduced the friction so much that the derrick could be swung by hand with ease by two men at the foot of the mast when a 25-ton load was suspended from the boom.

The top of the mast was enclosed in a conical cast-steel sleeve, made in halves bolted together through vertical flanges. The upper part had a reduced diameter forming a partial bearing on the top of the mast, and was turned to make a hollow gudgeon 10½ in. in diameter and about 6 in. high, with four spurs projected above the upper edge and passing through a cast steel cover-plate disc locked in place by cotters through the spurs. A cast steel ring engaged the gudgeon and was hooped by a 2½-in. welded circular band of Norway iron, shrunk into a horizontal groove in the casting and serving to retain the guy connection links which were set in slots in the casting behind the band. The vertical gudgeon bearing was fitted with ½-in. vertical hardened steel rollers, and in the inclined bearing a circular brass disc was inserted between the sleeve and the ring casting. The seven-part hoisting and topping-lift tackles were rove with ⅞-in. plough steel cables and the guys were made of 1¼-in. galvanized steel cables, all manufactured by the John A. Roebling's Sons Co.

The field rivets were driven by Chicago pneumatic hammers operated by a Chicago air compressor fitted with a Cutler automatic electrical regulating device, which admitted steam when the air pressure in the receiver fell below 100 lb. and cut it off when the pressure raised above 100 lb. The 1,730 tons of structural steel were erected in six weeks, a speed which is considered a record for such work in Philadelphia.

The building was designed and its construction supervised by D. H. Burnham & Co., architects; Mr. J. G. Giaver, structural engineer. The structural steel was fabricated at the Pencoyd plant of the American Bridge Co., and was erected by the general contractors, the Thompson-Starrett Co., of New York, Mr. George Simpson, chief engineer, and Mr. J. Cummings, superintendent in charge.

An Old Bridge in Western Turkey.

The accompanying illustration has been engraved from a photograph taken by Mr. Ralph Packard, Jr., while traveling over the highway between Monastir and Scutari. It spans the Drin River, and was built, according to local tradition, during the Roman occupation of the country. The characteristic feature of the wide and high arch at the piers and the smaller arches in the haunches is more Oriental than Roman, however, and any information tending to settle the matter will be gladly given space in these pages.

The Ozone Plant in West Philadelphia is now in operation and tests of its work in water purification have been made by Messrs. Rivas, Jackson and Hale. Raw Schuylkill River water contains as high as 2,500,000 bacteria per cubic centimeter. After rough straining this number is reduced to 250,000 to 700,000, and after the ozone treatment to 5 to 55. These few are all of harmless varieties, and the water is also deodorized and freed from color. The process, which is controlled in this country by the United Water Improvement Co., is substantially as follows: An electric current is taken from the city's wires to operate a motor generator, producing a current of 100 alternations, which is raised by transformers and condensers to a 10,000 voltage. By the operation of reactance coils and condensers, voltaic arcs are prevented and sparks are limited, and the current passes as a pencil of blue light from each of some millions of metallic discharge-points across a short air-gap to nickel receivers. Atmospheric-air is drawn across this gap by means of an air-pump, and in so passing is partially converted into ozone. The ozonized air is then forced through a stand-pipe, in which it meets a current of water flowing in the opposite direction. The contained bacteria are instantly destroyed by the ozone.

The Concrete Viaducts of the Thebes Bridge.

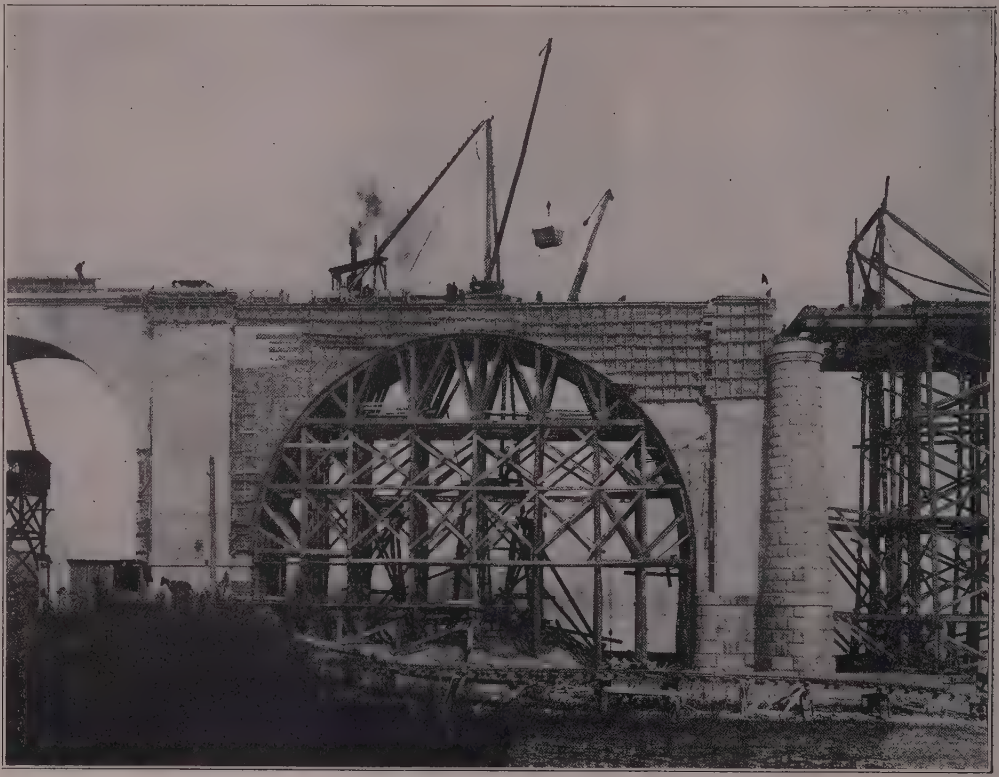
The approaches for the Thebes bridge across the Mississippi River consist of concrete arch viaducts with eleven clear spans of 65 ft. and one 100 ft. span. The viaduct is about 35 ft. wide over the parapet molding and has a maximum height of about 75 ft. over all above high water level. The clear width between parapet walls at base of rail is 25 ft. The structure is made throughout of solid monolithic concrete without reinforcement. It consists simply of the piers and the arches built continuous with them and longitudinal spandrel and parapet walls in the planes of the arch rings. The piers are all rectangular in plan, with vertical footings sunk to rock, and plain battered shafts with copings at the skewback level. Besides the two piers which serve as abutments at the ends of the steel spans, and the two which act as retaining walls at the shore ends of the approaches, there are two sizes of intermediate piers, every second or third one being made wide enough to give stability when subjected to the unbalanced pressure from arch thrust on one side only, thus dividing each approach into two independent units, which can be constructed or removed separately without jeopardizing the adjacent arches.

The small piers have 18x37-ft. footings and are 12 ft. wide at the skewbacks; the large ones are 20 ft. wide at the skewbacks. The 65-ft. arches have semi-circular intradoses 39 in. and 54 in. thick for the 65 ft. and 100 ft. spans, respectively. The radius of the extrados is 40 ft. 5 11-16 in. for the 65 ft. spans, giving the arch ring a thickness of 54 in. at the haunches. The spandrel walls are 10½ ft. thick at the base and 5½ ft. thick at the top, vertical on the outer faces and offset on the inner faces. The exposed surfaces of the concrete are plain except for the cornice and paneling in the parapet wall, and that the faces of the piers are carried up to the parapet walls, forming buttresses, which conceal the vertical expansion joints made in the spandrel walls at the piers. The arches are designed with ample concrete strength for the heaviest train and locomotive loads, and are not reinforced for strength, but have in each arch eight 1¼ in. square corrugated steel rods intended to prevent surface cracks and to locate the expansion and contraction movements at the joints provided for them. In each wall there are two curved rods transverse to the axis of the arch and parallel with the intrados and two horizontal rods in the top of the spandrel wall.

The ballasted track is laid on a bed of clay leveled up over the arches and piers by a fill of earth and gravel. Drainage is provided for by pipes bedded in the clay, and by cast-iron gratings between the arches, which both deliver to vertical 8-in. drain pipes at the centers of the piers. The parapet wall is built continuous with the spandrel walls, but as the center of gravity is close to the outer edge on account of the heavy overhanging moldings and the battered inner face, it is anchored with long inclined 1-in. tie rods 4 ft. apart and has steel dowels. The Portland cement concrete for the arches and spandrel walls and for the lower foot of the foundations is made 1:2:5; for the upper part of the foundations it is 1:3:7, and for the piers is 1:2½:6. About 50,000 bbl. of Chicago AA Portland cement were used in the work above ground.

All exposed surfaces are finished with a 2-in. mortar facing placed with the body of the concrete. The 100-ft. span was made similar to the 65-ft. spans with proportionate dimensions. The pier foundations were principally made in open excavations and difficulty was experienced in keeping out the water and on account of the very heavy external pressure from the clay on the sheeting. Three piers are built on reinforced concrete caissons sunk under atmospheric pressure by building the concrete pier on the concrete caisson roof. Three sets of arch centers were used so that all the spans in one group of arches between two wide piers could be built simultaneously. Most of the concrete was mixed with a Smith machine.

The 100-ft. arch was built on a special centering, which for about 75 or 80 ft. in the center had scarf boards supported on a vertical and two inclined square timbers at each panel point of the falsework. The latter consists of nine transverse bents of piles and framed timbers thoroughly X-braced longitudinally and transversely and supporting the arch lagging in the end panels by horizontal and diagonal braces against the scarf boards. The molds for the spandrel walls were made with horizontal boards and vertical outside pieces tied together through the wall. The large arch was built with a stiff-leg derrick with a very long spliced boom seated on a tower alongside and with a stiff-leg derrick on top.



Falsework and Molds for 100-Ft. Arch in Approach.

Comparative estimates were made for concrete arch approaches and for plate girder viaduct approaches with steel towers and showed a difference in first cost of from $10,000 to $20,000 in favor of the steel structure. Five important considerations, however, governed the adoption of the concrete. First, the approaches are subject to gases from locomotives passing underneath and would require, if of steel, to be painted frequently at an estimated cost of 15 to 20 cents per ton per year. Second, the concrete arches admit a very much greater increase of live loads than the steel viaduct could endure without injury. Third, the concrete arches with earth fill provide a roadbed substantially equivalent to one on the solid ground and thus practically reduce the length of the bridge, for traffic considerations, to the length of the main spans. Fourth, the concrete structure is absolutely safe from injury by derailment or fire. Fifth, about one-half the length of an economically designed steel viaduct here would be occupied by the towers, which, with ordinary construction, would be braced so as to preclude track laying through them, while in the concrete approach about three-fourths of the length is available for track laying.

Mr. Ralph Modjeski and Mr. Alfred Noble are the chief engineers of the Southern Illinois & Missouri Bridge Co., who built and own the bridge. Mr. W. E. Angier is resident engineer, and McArthur Brothers, Chicago, are the contractors for the concrete approaches.

Enormous Earth Dams.

A number of brief references have been made in the daily press to a remarkable dam now under construction on the Alamosa River, in southwestern Colorado, by the San Luis Valley Irrigation, Land & Power Company. The basin it will form is known as the Terrace Reservoir, and the dam was originally projected by Mr. Thomas W. Jaycox, state engineer, prior to his appointment to his office. It is now being built under his general supervision, with the co-operation of Mr. James D. Schuyler, consulting hydraulic engineer of Los Angeles, and the latter has furnished the following statement of the reason why such a high dam is considered feasible and necessary for an irrigation storage reservoir.

The area of the watershed of the Alamosa above the site of the dam is 120 square miles, from which the mean annual runoff is about 60,000 acre-feet and the maximum about 100,000. The river at the site of the dam passes through a narrow, tortuous gorge or cut about 70 ft. deep, and in places not over 15 ft. wide. On the axis of the dam the width is from 30 to 40 ft. between vertical walls of rock. Above the top of this gorge the valley widens out in the usual form and at the crest line, 110 ft. above the top of the gorge, its width is 480 ft.

A concrete cut-off wall is to be built on the center line, extending up about 6 ft. above the top of the gorge. There will be a reinforcement of vertical and horizontal bars on both the upper and lower faces. It is arched in plan to a radius of 50 ft., and will have a thickness of 10 ft. at the base and 4 ft. at the top. At the top of the gorge the wall will diverge on either side into two, going up the slopes to the top 20 ft. apart. These will be set in a trench in bedrock, will be about 4 ft. thick, and have a height of about 6 ft. above the natural surface. The dam proper will be a hydraulic fill, sluiced into position from the adjoining mountain sides. It will consist of about 50 per cent. of boulders of all sizes, from gravel up to stones a foot or more in diameter, and angular spawls of rock, about 25 per cent. of clay and 25 per cent. of sand, forming what may be termed a clay concrete puddle core. The dam will have a slope of 3:1 on the upper side and 2:1 on the lower side, and a width of 20 ft. at the crest. The volume of material required is about 430,000 cu. yd., and a ditch about 6 miles long is now being built to deliver water for sluicing this material at a height of 200 ft. above the top of the dam.

The outlet will be a tunnel 722 ft. long, 10 ft. wide and 7 ft. high, cut in solid trachyte bedrock, with a gate shaft 75 ft. deep at the outer slope where two 48-in. gate valves will be located. The spillway will be over a ridge about 1,000 ft. north of the dam, and will be 15 ft. below the crest of the latter. The spillway will be about 200 ft. long and will have a continuation 400 ft. long and 13 ft. below the crest of the dam.

The Mexican Light & Power Co., Ltd., of which Mr. Schuyler is the consulting hydraulic engineer on dam construction, is preparing to build three hydraulic fill dams, one of which is to be 55 meters in height and contain about 1,500,000 cubic meters of material. The crest will be 15 meters wide and the slopes will be 3:1 and 2:1 on the upper and lower faces respectively. The other two dams will be of somewhat smaller dimensions, but over 130 ft. in height.

Stereoscopic Vision Applied to Surveying.

Last November it was the privilege of Mr. E. F. Northrup to meet Dr. Czapski, technical director of the Carl Zeiss works at Jena, and to learn from him the interesting developments in optics that this noted house has recently been making. Of several strikingly new instruments shown, the two that especially interested Mr. Northrup were the "telemeter" and the "stereocomparator," a description of which he has contributed to the "Proceedings" of the Engineers' Club of Philadelphia. Both these instruments make use of and apply in many useful ways the principle of stereoscopic vision. Few persons who have not given the subject special study realize the remarkable features, the usefulness and power of making accurate measurement of binocular or stereoscopic vision.

If two photographs of an object are taken from slightly different points of view, the two pictures obtained are sufficiently unlike so that, if by any optical device it is attempted to blend them together by superposition or otherwise, the result can only be a blurred and confused image. But put these two unlike photographs in a stereoscope, or any device by which the right eye sees only the one view and the left eye sees only the other, and instantly the two unlike views blend together in the brain, giving the sensation of a clear image, in outline slightly different from either component view, and possessing the additional property of depth or relief. If two diagrams are drawn, one consisting of a circle with a black dot in its center and the other like it except that the dot is placed slightly out of the center of the circle, and these two diagrams be combined in a stereoscope, it will be observed that in the combined image the dot will appear above or below the plane of the circle. In general the principle is found to hold in stereopscopic vision that when two similar views are stereoscopically combined all relative lateral displacements of objects in the two views in a line joining the oculars produce the physiologic sensation of difference in depth of these objects. Thus, if one view is that of the starry firmament taken at one hour and the other view is of the same part of the firmament, but taken at a later hour, after a planet has had time to move slightly relatively to the background of the stars, these two views will combine in a stereoscope, and the image of the planet will appear to stand out in front of and away from the background of the firmament of stars. Surely such a remarkable power of the brain which can combine in its sensorium two unlike images and give a third different from either, must appear quite inexplicable and as being a gift of Nature which may truly be called a sixth sense.

In the telemeter we have a binocular telescope which measures the distance, up to several thousand feet, of any object that comes in the field of view. To accomplish this an ingenious application is made of the principle that lateral displacement in the line joining the eyes of an object in one of two stereoscopic views, produces in the stereoscopic image an apparent displacement in depth of the object so displaced. In each of the eye-pieces of the binocular combination at the plane where the two images of the landscape are formed are two small circles ruled on glass. These two circles appear as one when looking through the binocular glass. By means of a micrometer screw adjustment the circle in the right-eye tube can be slightly displaced in the line joining the eye-pieces of the telescope. As this displacement is made the little circle appears to move off into space. Its position in space can be perfectly controlled by the screw. To determine, then, the distance to any object in the landscape, it is only necessary to look at it through the binocular telescope and turn the micrometer screw until the ring appears to hang just over the top of the object, and then read off the distance in meters on a scale attached to the controlling screw. Such is the Carl Zeiss telemeter. It is made up in various sizes, in which by a simple optical device the effective distance between the eyes is increased to about 3 m., as much as 3,000 m. can be determined to a precision amounting to 4 per cent., and smaller distances to far greater accuracy. The uses of such an instrument are obvious, such as finding the range for guns in war or in hunting with a rifle, in rapidly making a quick and preliminary survey of a rough country or a coast-line as a boat moves along it, estimating the distance of objects over water, and many other purposes of use and pleasure. Dr. Czapski showed a small Zeiss field glass fitted with the telemeter attachment, and Mr. Northrup could, with great precision, ease and rapidity, determine the distance of any object within a distance of 300 to 500 m. He was impressed with the great usefulness which it would have in the hands of surveyors for all kinds of preliminary work. Objects of uncertain outline, as a column of smoke, can be located in reference to distance, in the horizontal or vertical direction, as well as sharply outlined objects; hence the telemeter should prove of use in determining the height of clouds, mists, etc.

But, interesting as is the Zeiss telemeter, it is surpassed by the stereocomparator. This instrument, while embodying in effect all the principles of the telemeter, is designed to make surveys of photographs of a landscape in a manner similar to that which is done with the telemeter on an actual landscape.

The instrument, briefly described, is a very large stereoscope adapted to viewing in detail with considerable magnification or as a whole two photographic positives 13 by 18 cm. each. By means of lenses and mirrors the effective distance between the eyes is increased to 18 cm. or more. The frame of the instrument has adjustments for moving the two plates being viewed together in any direction in a plane, and relatively in any direction to each other. The two eye-pieces of the instrument have at the planes where the images are formed each a small scratch on glass. When looking into the instrument these two scratches, as well as the photographs, combine stereoscopically and there is seen a mark suspended in space on the landscape. By adjusting various screws, having scales or indices attached, this mark can be moved apparently over the landscape relief view in the three dimensions of space. Like a surveyor's rod, it can be moved about and placed at will wherever desired, the extent of its movements being accurately known by readings given on indicating scales. Hence it becomes possible to make from two carefully and properly taken photographs a complete survey of all the features of a landscape which are visible from two nearby points of view. By taking a number of sets of views from different standpoints the entire contour of the landscape can be surveyed. Methods are available for the conversion of focal co-ordinates, read off on the apparatus into co-ordinates of dimension. Thus drawings can be readily and exactly made at home on the plane table without any calculations whatever, use being made of the stereoscopic relief picture seen in the stereocomparator.

The makers of this remarkable apparatus do not claim that the stereocomparator will replace the usual methods of surveying, but that both may be used to the greatest advantage side by side in mutual co-operation. Thus the special usefulness of the stereoscopic method in surveying may be found for the production of most exact topographical plans, the construction of contours, profiles and models, for the production of plans of inaccessible places, as chasms, mountain heights and the like. The prospectus published in English by Carl Zeiss summarizes the numerous applications of this instrument and methods to other purposes than surveying.

Thus, in stellar astronomy it may be used for the rapid detection and study of any small relative displacement of any of the celestial bodies. In observations on the sun the method is useful for studying the proper movements of sun spots as distinct from their common movement with the rotation of the sun. In observations on the moon the power of the stereocomparator is made marvelously manifest. Two photographs of the moon being taken at different intervals of time give the data for determining the height of the mountains on the moon and the diameter of the craters on its border by means of the traveling index. The comparator finds also many uses in metronomy for the rapid comparison of scales, spectral lines and the like. It is useful in meteorology, geology and architecture.

Paint Films can be prepared readily for laboratory purposes by a method recently devised by Mr. G. A. Thompson. Take a piece of tinned plate, amalgamate this thoroughly with mercury—dry—rub off the excess of mercury and repeat this operation after the end of twelve hours. If this amalgamated surface is painted with linseed oil paint, the paint may be removed from the surface almost intact, when dry, by rolling it on a glass rod ½-in. in diameter, from which it may be unrolled and hung in a proper place until needed for testing. Films so prepared may be subjected to such accelerating and destructive influences as may be desired and their relative behavior noted. Changes in elasticity, weight, specific gravity, shrinkage, tenacity are to be looked for, and when found such changes are to be considered signs of decay.

Curing Concrete Blocks.

By H. H. Rice, Denver, Colo.

The essential difference between the use of concrete blocks and monolithic construction lies in the opportunity afforded by the former of thoroughly curing the blocks before they are placed in the wall. Properly cured blocks are, at time of laying, as truly stone as though the formation had been effected by nature's process rather than by the art of man. In many cases, however, inadequate knowledge of the science of curing and failure to employ the practical precautions requisite to insure the best results render blocks totally unfit for use. It is more largely due to such ignorance and negligence than to any other cause that many persons have become prejudiced against the use of this eminently fit building material.

The great characteristic of cement is its hydraulic activity and resultant crystallization. Its value as a cementitious agent depends solely upon the thoroughness and uniformity of crystallization. The silicates cannot attain that full crystallization necessary for maximum strength and greatest durability without the maintenance for a considerable period of time of conditions both favorable and uniform.

The initial and final sets are but expressions denoting certain stages in the process of crystallization. The former denotes the attainment of a degree of strength in which the block retains its shape against a slight jar; the latter denotes the attainment of rigidity akin to natural stone. Now, it is evident that whatever are the conditions producing the chemical action manifested in the initial set, they must be substantially maintained to secure the most efficient final set.

It is, however, evident that the requirements of such maintenance will vary according to the mixture used and the condition of the block when taken from the mold. In a medium mixture (a mixture from which tamping or pressure will cause water to slightly flush) there is somewhat more moisture than necessary for the initial set, and subsequent sprinkling from seven to ten days will suffice. In the dry mixture there is barely enough water for the initial set, and copious sprinkling should begin as early as may be possible without damage to appearance and continue for twenty or thirty days.

Time is of the essence of scientific curing. The exigencies of modern business tempt the block maker, almost beyond power of resistance, to shorten the time of curing and thus sacrifice quality for speed of construction. To this end curing by steam has been the subject of some experiments, the results of which demonstrate that steam accelerates partial crystallization, but the tests thus far made have failed to prove that the full strength of the cement is utilized, and until that be accomplished steam curing can scarcely be recommended. To rush partially cured blocks into a wall is an error so grave that the saving in time is no just compensation for the evil results which will surely ensue as the direct result of the absence of conditions requisite to a thorough scientific cure.

In stacking blocks in the curing yard let all faces be turned one way, and discoloration avoided by not allowing any part of one block to rest in contact with the face of another. Do not pile blocks one upon another, but avoid contact and permit free circulation of air by using pieces of lath between tiers.

In sprinkling use a fine spray and let it play on the back, as the impact of water will ruin a freshly made face. Let sprinkling be thorough and at such intervals that no portion of a block will dry out. Remember, always, that drying is not curing.

The failure to maintain a uniform condition of moisture during curing causes variation in contraction, and is responsible for most of the cracks developed. Uniformity of temperature should not be disregarded and may usually be sufficiently maintained by thorough sprinkling, provided that blocks are properly sheltered from the direct rays of the sun. To expose blocks without such shelter while curing is fatal, and will result in ultimate disintegration and crumbling.

To avoid expansion cracks, blocks should not be frozen during the first few days of their existence. The curing of blocks in winter is, however, by no means impracticable, although requiring more time, as crystallization is slower and is almost entirely suspended when the temperature is a few degrees below freezing. It is, however, merely a suspension and is resumed upon a rise in temperature.

Climatic conditions must also be considered. A dry atmosphere or intense extremes of heat and cold will require greater care than a humid atmosphere or a comparatively even temperature.

The influence of care or carelessness in curing on uniformity or diversity of color is seldom appreciated. This is a point worthy of careful study and exhaustive experimentation, for the day is at hand when the man who is heedless as to a pleasing and uniform color in his product may not hope to meet the demand for the artistic in concrete block construction.

Strength is the great essential—the final test by which every building material must stand or fall—and in this regard scientific curing is of prime importance. Cement is the bonding element, attaining its ultimate strength only by thorough crystallization, and thorough crystallization is only secured by unscientific curing.

I have been asked by men, otherwise intelligent, how long it took blocks to dry out. I have seen blocks, otherwise good, exposed to the intense heat of a summer sun and given little or no attention. Is it strange that such practice should produce blocks porous, unsightly and weak? Is it fair to the people who desire to avail themselves of the advantages of this construction, and who rely upon the knowledge and integrity of the manufacturer? Let us apply scientific methods to our work if we desire permanent and enduring success.

Sulphates of Iron and Lime are to be used as coagulants at the New Orleans water purification works, instead of sulphate of alumina as originally proposed.

Removal of the Diverting Dam of the Ontario Power Co.

The diverting dam in the Niagara River which has shielded the intake works of the Ontario Power Company during their construction, is now being rapidly and successfully removed. This dam was built in 1903, extending out from shore above the upper line of rapids and laying dry an area of about 18 acres, including the water courses about the Dufferin Islands. In June water to operate the first 10,000-h.p. unit was admitted to the forebays by a sluiceway cut through the dam.

This diverting dam is about 900 ft. long, 250 ft. of it extending out from shore at nearly a right angle, and the remainder running at an angle down the stream, thus turning the water out toward the middle of the river. It is built of bottom cribs 31 ft. long, 16 ft. wide and 11 ft. deep, which were floated into place, and sunk by loading with stone. No puddle was used, but the dam was made tight by bags of cement placed on the rock bed of the river against the upstream face of the cribs, and by double-lapped tongue-and-groove sheet piling driven into these bags. A diver, protected from the swift current by a timber shield, placed the bags of cement and fitted the piling to conform to the irregularities of the river bed. This construction has proved very successful, as very little water has leaked through the dam.

Removing the Diverting Dam of the Ontario Power Co.

The removal of the dam is accomplished by unloading sections or cribs one at a time, and by swinging them as on a hinge in toward the shore, into the quiet water behind the remaining portion of the dam. The stone fill is removed by common labor, no diver being required. An interesting, and in fact surprising, feature of the operation of removal, is that after a crib is unloaded, in spite of the terrific force of the current, it seems almost as stable as before, although held in place only by the small quantity of cement above mentioned. The combined power of a hoisting engine on shore and a derrick on the dam is required to loosen the cribs from the bed of the river, after which they swing easily around toward the shore, as shown in accompanying illustration.

A Producer Gas Plant is used in a small public lighting station at Church Stretton. Two Dawson suction producers fed with pea anthracite are used, with two 80-h.p. gas engines belted to the dynamos.

Chicago Foundations.

A paper by Mr. E. C. Shankland in the "Technograph" of the Engineering Societies of the University of Illinois.

Horace says in De Arte Poetica, "It is difficult to treat common topics with originality." There has been so much written regarding foundations for high buildings in Chicago that it is difficult to write anything that is not trite, and it is practically impossible to say anything new. The soil on which Chicago is built consists of loam and made ground down to datum, about 14 ft. below street grade, then comes a layer of hard, stiff blue clay 6 to 12 ft. thick; below this the clay, while generally of the same character as the hard stratum above, becomes softer, and remains soft to a depth of 60 to 70 ft. below street grade. This soft layer, as a general thing, only differs from the hard layer above in the amount of water it contains, and the buildings in their settlement squeeze out this water, thus increasing the thickness of the hard layer.

When the foundations of the new post office were put in, extremely hard clay, that had to be cut out with draw knives and thrown into the wagons with pitchforks, was found down to a depth of 35 or 36 ft., although when buildings near it were built soft clay was found at about 20 ft. below grade.

It was found early in the use of spread footings that it was not advisable to dig into the hard stratum at all. The foundations were placed upon this hard stratum wherever it was found, and this in some cases only allowed a clear height in the basement of 7½ or 8 ft. Before the Masonic Temple was built the soil was tested by supporting a tank on a plate having an area of 2 sq. ft. This tank was gradually filled with water. The final load was 5,650 lb. per sq. ft. Two tests were made, each lasting about 100 hours. In one test the plate rested directly on the top of the hard clay. In the second test the plate was placed at the bottom of an excavation in the hard clay 2 ft. 4 in. deep. The total settlement in test No. 1 was 1 13/16 in. and in No. 2 4⅛ in. Below this soft clay comes a very hard, compact clay, frequently containing boulders of various sizes, some of them being 5 or 6 ft. in diameter. This clay continues down to either the rock or a layer of sand and gravel of varying thickness which occasionally overlies the rock. Rock is found in the downtown district at about 100 ft. below street grade. In an artesian well sunk at the Chicago & Northwestern office building now being completed this limestone rock started at 100 ft. below datum and continued down to 434, then came a layer of blue shale 53 ft. thick, then 350 ft. of limestone, then 160 ft. of soft white sandstone, then 300 ft. of limestone, and finally at 1,400 ft. a white sandstone was found which contained water in sufficient quantity, rising to within 100 ft. of the surface.

The old masonry foundations of the four to six-story buildings erected after the fire were, of course, spread foundations, and their load on the clay ran from 8,000 to 15,000 lb. per sq. ft. There must have been great settlements, but with the streets varying so much in grade as they did, and with the masonry buildings, it did not make much difference how much they settled. However, as the heights of buildings increased and more room in the basements for mechanical plants became a necessity, it was found that some other kind of foundation was required, and the spread footing made of layers of beams imbedded in concrete followed naturally. The settlements of buildings supported upon these spread foundations were considerable, ranging from 8 in. to as much as 30 in. This settlement is anticipated when construction is begun by raising the level of the bottom of the footings by the amount it is thought the buildings will settle. This causes the sidewalks to be steep at first, but they approach their proper slope as the buildings settle. The foundations of the Great Northern Theater were raised 9 in.

It has also been found that the tall buildings with spread foundations do not stop settling. This continual settlement is caused by the wind tending to reduce the pressure on the soil on the windward and increasing it on the leeward side. Some of the tallest buildings erected 12 to 15 years ago are still settling—very slightly, it is true, but the movement is enough to be detected. Another fact noted is that all the tall steel buildings lean north and east. This is due to the fact that in the spring and summer, when the buildings are being erected, the prevailing winds are from the southwest, and as the greatest settlement occurs during erection, this constant pressure against the unfinished structures is sufficient to cause them to lean slightly.

The following incident will show how great is the initial settlement. In the Masonic Temple four of the main columns, near the lifts, carry heavy loads and have large footings, and between them are two small columns which only carry the stairs. As these had much smaller footings than any others in the building, they were given a higher load per square foot. During the construction of the building the four columns had received the greater portion of their loads when the erection of the stairs was begun. It was found at once that the connections on the stairs would not fit those on the columns, the latter being too high. Levels, taken to ascertain whether the small columns had been forced up, showed that they simply had not settled with the rest of the building. About 75 tons of pig iron were then loaded on both footings and allowed to remain for a week. Although the load then amounted to 7,000 lb. per square foot, twice the load on any of the other footings, the column only settled about 1 in., less than one-half the desired amount, and so the connections had to be changed all the way up the stairs.

It was found early in the history of floating foundations that live load must not be considered when designing foundations. The reason for that is that the foundations get the dead load immediately, but the live load does not come on until the building is finished and the greater part of the settlement has taken place.

One of the finest buildings in Chicago, a wholesale warehouse built nearly 30 years ago, was designed by a Boston architect. He proportioned the foundations for the same live and dead load he used in designing his columns. The result was that the outside walls, where the percentage of dead load was very great, settled at once, and the interior columns, where the percentage of live load predominated, did not settle. If you go into that building today you will see porters helping the regular truckmen to wheel their trucks up the hills caused by the curve in the floors.

The great settlement of buildings in these floating foundations and the necessity for increased basement height, owing to the increasing use of water tube boilers and other improvements in the mechanical plant, lead to the gradual abandonment of this style of foundation, notwithstanding its cheapness. But the chief reason for the change and the discarding of the spread footings was the building of the tunnel by the Illinois Tunnel Co. This was a remarkable piece of work. Thirty miles of this tunnel 40 ft. below street grade have been completed, and the whole work has been carried on without any tearing up of the streets. Indeed, very few people in Chicago knew it was being built until it was practically completed. Shafts were sunk at curb line, and the dirt was hoisted through these shafts and carted away at night. This tunnel, together with the present agitation about subways for the street car lines, render the concrete walls going to rock the only safe method of constructing foundations for high buildings in the business district.

Many of the buildings now being erected have basements going down to the level of this tunnel. A great deal of the clay excavated in foundations of buildings is now taken out to the lake through this tunnel, saving the teaming of it through the streets.

While most of the large warehouses along the river are on piles and a few in the business center rest on piles, yet a very large percentage of the buildings put up in the past five or six years rest on concrete caissons. Concrete wells would be a better name, as they are simply holes dug just as ordinary wells are and filled with concrete. These were first used in Chicago in the Stock Exchange erected in 1892, but two years before this the City Hall in Kansas City was built upon steel shells going down to rock, excavated and filled up with hard brick laid in Portland cement. Excessive loads were carried on Z-bar columns passing through the centers of the piers and going down to rock. The site of the building was formerly a ravine between abrupt bluffs. These had been so cut away and leveled as to leave a 50-ft. filling of rubbish under two-thirds of the building and a solid clay bank under the other third. The fill was made by its use as a public dump. This is the first building I know of to make use of this kind of foundation.

The concrete wells as now built are put down 4 or 5 ft. and then lined with wooden lagging 2 to 3 in. thick, tongued and grooved, and either 4 ft. or 5 ft. 4 in. long. Each section of this lagging is held in place by two steel bars, generally 4 in. wide by ¾ in. thick, made semi-circular, in two pieces turned up at the ends, so they can be bolted together. If the ground is unusually soft three rings are used in each section, and the sections are made shorter. When the first section is lined a new section is dug and lined up, and so on down to the hard clay 60 to 70 ft., or to the rock, as the case may be.

Where the wells are only carried down to the hard clay they are belled out at the bottom to twice the diameter of the shaft, but if carried down to the rock, which is the better way, they are not belled. When the holes are excavated to the bottom the concreting is begun and the rings are taken out as the work of filling progresses. Sometimes the lagging is also taken out, but this is not done as a general thing. When soft, swelling clay is found, or where the well is close to a high building previously erected on spread footings, both the rings and lagging are left in as a means of safety.

It is sometimes necessary to use iron shells for lagging for a portion of the distance. In the Chicago Edison building recently erected at the corner of Market and Washington Sts. a very soft sand stratum full of water was discovered at a depth of 85 ft. It might also be called quicksand. It was necessary to get iron shells and drive them down ahead of the digging, as that was the only way the water could be kept out by the pumps.

These wells do not settle in themselves, still they cause some settlement to adjoining buildings. This is due to the impossibility of digging the clay so that the lagging will fit close to it. There are bound to be vacant spaces back of the lagging which will be filled up later by the earth pressure, and this movement will show itself in the settlement of the foundations of the buildings close by. Slight settlements in a building across a 40-ft. street have been known to occur, presumably from this cause.

With spread footings the maximum load on the clay was 3,500 lb. per square foot; generally a load of 3,000 lb. per foot was used. Concrete wells are proportioned for a load of 40,000 to 45,000 lb. per square foot at the top. This means for a belled well, about 14,000 lb. per square foot on the clay and about 60,000 lb. per square foot if it is carried down to rock. For piles the maximum load allowed by the city ordinance is 25 tons per pile, but generally the load does not exceed 20 tons per pile, although 50-ft. piles, driven to a stand, are good for 50 tons.

One great advantage of concrete wells is that they can be constructed before the old building is taken down. When Schlesinger & Mayer built their corner store on State and Madison Sts. all the wells for the new building were put in without the crowds in the store knowing anything about it, and the crowds were unusually great, as the work was done during the Christmas shopping season. Of course, part of the basement had to be given up, but all the dirt excavated was hauled away at night.

At the present time wells are being sunk in the basement of a 5-story building at the corner of Monroe and LaSalle Sts., which had been occupied up to May 1, when the building was torn down to make way for the Northern Trust Bank building. This saves from 30 to 60 days in erecting the building, a very important item.

Another form of foundations which has not been mentioned is concrete piling in places where wooden piles or spread footings cannot be used and concrete wells are too expensive. Wooden piles have to be cut off at or below datum, which is 14 to 15 ft. below the surface of the ground. This is all right where there are basements, but in some cases a basement is not required. Then, if wooden piles are used, the footings will have to be excavated to datum, the piles driven and cut off at datum or lower, and a stone or concrete pier built up to the basement floor. This is very expensive.

A good example is the power house recently erected by the Union Electric Co. at Dubuque, Iowa. The site is on the bank of the Mississippi River, on sand. No basement was required. The variation of the gauge of the river at that point is about 22½ ft., and the ground at that point was about the level of high water. Spread footings were out of the question, and if wooden piles were used the piers would have to be excavated to a depth of 22½ ft. This was equally out of the question, but concrete piles solved the difficulty.

One of the most interesting and very often one of the most difficult problems in the constructional design of a tall building is the foundation for the party wall. An example is the Great Northern Theater and Hotel building, running from Jackson to Quincy and adjoining the Great Northern Hotel on the east. The east wall is a party wall, with foundations 22 in. wide. The theater is in the center of the east building, and its walls, running east and west and carrying the walls of the building above the theater, weigh 60 tons per linear foot.

The problem was to take care of this wall where it ran over the east side of the party wall and joined the wall. It was done by cutting through the party wall and putting in girders parallel to the theater walls and supporting them. These girders were supported on 30-ton jack screws, and as the new building settled the screws were run down to keep the girders level. In addition to the two theater walls there were four other points where the new building joined the party wall, and these were also put on screws. The theatre building is about 10 years old, and the screws are still being watched. When the settlement has stopped the jacks will be imbedded in concrete.

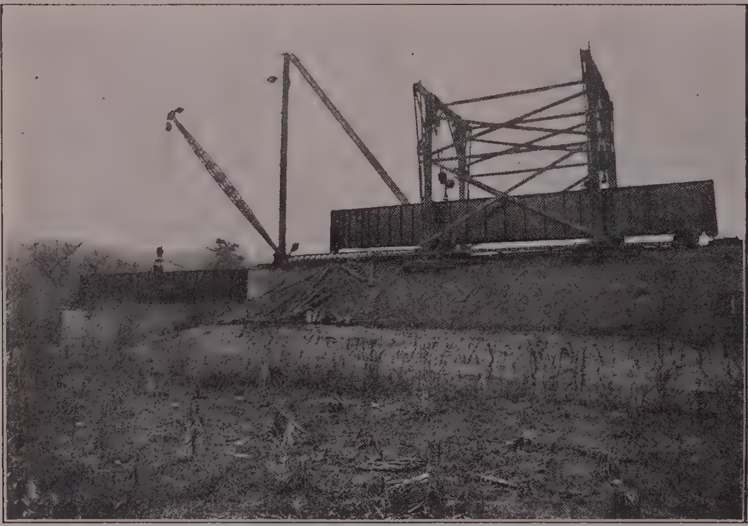
In the case of the Journal building there was no party wall contact on either side. It was, therefore, necessary to keep entirely on the lot. There are four columns in a row transversely, and these columns rest on double cantilever girders the full width of the lot, 41 ft., and these rest on piles which it was not necessary to drive closer than 6 to 7 ft. from the walls of the adjoining buildings.

One of the earlier examples of cantilever girders is the Rand-McNally building erected in 1889. This building is on spread foundations. While party walls were desirable when spread footings were used, the contrary is the case now that concrete wells are in such general use. The wells can be kept entirely on the property, and cantilever girders in the foundation will allow the columns to be put close to the lot line. In the Chicago & Northwestern office building there are cantilever girders in the foundations weighing over 26 tons apiece.

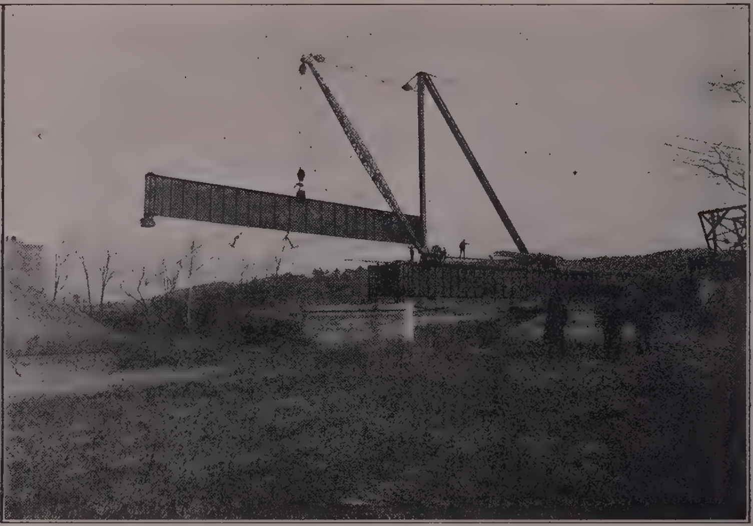
Four 27-in. Electrically Driven Centrifugal Pumps, with a combined capacity of 52,000 gal. per minute against a total lift of 45 ft., have been built for a dock pumping plant in England. Each pump is direct connected to a 350-b.-h.-p., open-type motor, shunt wound for 220 volts and 1,300 amperes, and, according to Engineering, has a cast-iron impeller 38 in. in diameter designed to run at 375 r.p.m.

The Erection of the Great Tonoloway Creek Bridge.

The Western Maryland R. R. crosses the Great Tonoloway Creek on a deck bridge having three single-track plate-girder skew spans of 76 ft. 2 in., 80 ft. 6 in. and 84 ft. 11 in. on a sub-structure built to receive two additional lines of girders when the road is double-tracked. The girders weigh, respectively, 42,680 lb., 47,160 lb. and 52,000 lb. and were riveted up complete in the shops and shipped to the site on ordinary flat cars, from which they were unloaded by a pair of gallows frames braced longitudinally by two 1¼-in. steel guy cables, which were continuous from one gallows frame to the other. Four tackles were suspended from the cap of each gallows frame and operated by a four-drum 10x12-in. Lidgerwood hoisting engine so as to lift the girders and fleet them transversely to the parallel material track, where they were loaded as required on a special four-wheel material car with heavy plate-girder platform, 5 ft. long, which was built at the bridge shops for use in the erection of the Niagara Arch bridge.



Unloading Girder and Erecting First Span.

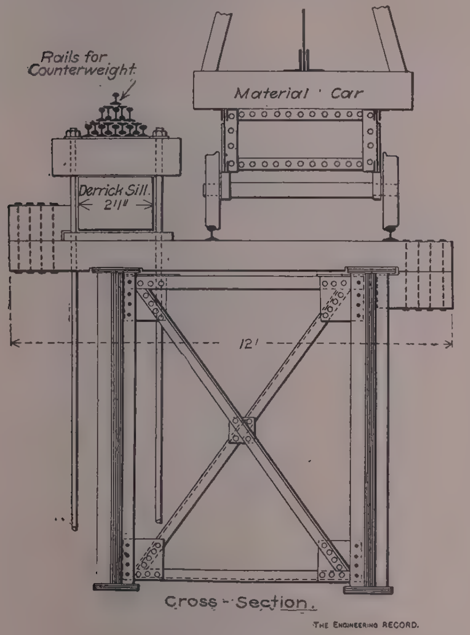


Derrick on Second Span, Erecting Third Span.

For the erection of the first span a 30-ton steel derrick with a 55-ft. mast and a single steel stiff-leg and a steel horizontal sill were set up on the abutment with the sill parallel to the bridge axis and extending back to the nearest gallows frame. The derrick was guyed with three 1¼-in. wire cables on one side and with two 1¼-in. cables on the opposite side over the service track, which passed close to the foot of the mast. Care was taken to give the guys an inclination no greater than 1 vertical to 2 horizontal, and the derrick was anchored by supporting the center of gravity of the two 47,000-lb. girders of span 2 on cross pieces at the extremity of the sill, the ends of the girders reaching through between the legs of the gallows frames and close to them, so as to clear the material track.

The derrick weighed about 21 tons when rigged with 6-part boom tackles and 4-part hoisting tackles and was the same one which was used for the erection of the Williamsburg bridge, New York, and was illustrated in The Engineering Record of Jan. 2, 1904. It was seated so close to the track that there was no room for the flat cars on which the girders were received from the shops to pass alongside, and if there had been, the forward cars could not have moved far enough past the derrick to enable the center of gravity of the girder to be brought between the derrick mast and the river, where it should be to allow the derrick boom to lift the girder without swinging it around through a large arc under the guys, an operation deemed unwise with so heavy and long a member. The provision for unloading the girders separately by the gallows frames allowed them to be delivered, loaded, on their centers of gravity on a single small car which could be pushed beyond the derrick mast and into an advantageous position for handling with the boom; it also enabled the girders to be unloaded quickly as received and stored so as to have a number in readiness for uninterrupted erection and allowed the cars on which they were shipped to be released immediately and thus save demurrage charges. The use of both derrick and gallows frames also saved the necessity of moving the gallows frames for every span, as would have been necessary if all the work had been done with them and no derrick employed.

The girders were pushed forward on the tracks until they were clear of the gallows frames and could be lifted by the derrick boom, which successively swung them into position on the substructure. Before being handled by the derrick, the shoes, pedestals and bed plates were assembled at the ends of the girders and were lashed securely to them.

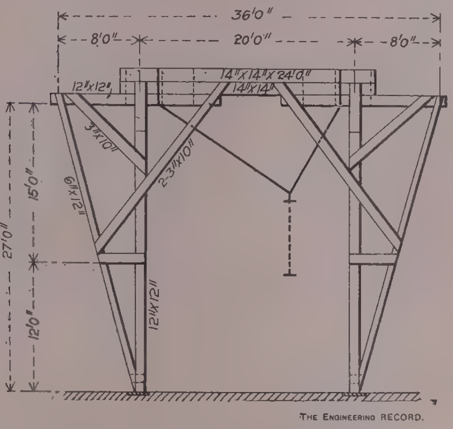


Anchorage of Derrick Sill.

The clamps used for handling the girders were of a special pattern designed and made by the contractors and very much liked by the erectors on account of their safety and the quickness with which they could be adjusted and removed. Each has two separate main side pieces made with vertical plates parallel with the girder web. Across the lower inside face of each plate is riveted a horizontal shelf angle with an oak bearing piece bolted to the upper side and vertical distributing angles bearing against the under side of the horizontal flange. The plate is stiffened by a pair of vertical angles riveted on the outside and the two plates are connected by a horizontal ¾-in. bolt and a horizontal pin, both through the upper ends of the plates. The pin has separator sleeves to space the plates from 16 to 22 in. apart and the ends are secured by cotters. It engages welded eyes on the lower ends of a bent hanger rod, the loop of which engages the shackle on the lower block of the hoisting tackle. By simply loosening the bolt and removing the cotters the clamps may be set to engage the top flange of the girder and receive it on the horizontal bearing angles, which are locked in position by screwing up the bolt and replacing the cotters. The clamp is good for 50 tons and can fit almost any girder. Four-part tackles were attached to the clamps and used as tag lines to swing the girder to the required position.

After the girders of the first span were set in position they were braced by diagonal struts engaging the top flanges until the transverse bracing and laterals were assembled. The ties were laid on their top flanges, the track was continued on them to the first pier and the derrick was moved forward until its mast was seated on one girder near the river end, where it was guyed as before. The shore end of the derrick sill was anchored to the girder by four 2-in. vertical rods and the river end was similarly anchored by two rods as close as convenient to the foot of the mast. Additional security was provided by a counterweight of 10,000 lb. of rails secured to the opposite end of the girder on which the derrick was seated, as shown in the detail.

The uplift at the foot of the stiff-leg was 75,600 lb. and the weight of the girder, track and rail ballast provided an abutment reaction of 63,100 lb., giving an excess of 5,100 lb., which proved ample for security. In order to clear the stiff-leg with the special girder truck, the permanent track was shifted eccentric with the axis of the span until one rail was 6 in. beyond the center of the girder opposite the derrick sill. Where the derrick sill was clamped to the girder it was seated on 3-in. oak bearing planks on special cross ties. These ties were dapped over the top flanges of the girders and reaction blocks were bolted to them at both ends to receive any transverse thrust. In handling the first span girders, when the derrick was seated on the abutment, the maximum uplift at the foot of the stiff-leg was 63,800 lb., which was resisted by an effective counterweight of 74,000 lb. applied at the same point.



Gallows for Unloading Girders.

After the last span was erected the derrick was pulled back on the tops of the girders to the first abutment by the stationary hoisting engine and there taken down.

The gallows frames were of improved construction with double caps supported on the upper horizontal members of the transverse bracing in such a manner that the latter acted as corbels and increased the beam strength of the caps. The gallows frames were very light and stiff and both together contained only 5,000 ft. b.m. of timber, all yellow pine. Those for the Tonoloway Creek bridge were rigged with four-part manilla rope tackles, which cost over $200 for each gallows frame. In erecting the bridges at the seventh, eighth and ninth crossings of the Potomac River, each of which had four 95-ft. spans, and the fifth, sixth and seventh canal crossings, each of which had a 26,000-lb., 80-ft. girder span, the gallows frames were each rigged with two 10-ton differential block chain hoists, which were found much quicker and more satisfactory than the tackles. With them the girders were lifted a few inches and the cars immediately removed, then the girders were fleeted by the hoists and lowered on cribbing alongside the track, which could accommodate three girders at once. Transverse rails were put on top of the cribbing to safeguard the girders as they were being lowered, but no accidents occurred to make their use necessary. Afterwards the girders were skidded transversely from the cribbing to the cars on which they were delivered to the erecting derrick. By this method storage was provided for four girders, including the one in the chain hoists, and erection was more independent of deliveries and the use of the shifting engine. A girder could be unloaded and the cars removed in about 20 minutes. A total erection force of from 15 to 30 men erected one four-span bridge in about 10 days, inclusive of the time required for setting up, rigging, moving and taking down derrick and gallows frames, but exclusive of the time required for riveting and painting the work, which was done at convenience after the erectors had finished. To swing one girder from its car to final position on the piers was a very rapid operation, requiring about 12 men for 15 minutes.

The bridges were designed under the direction of the engineering department of the Western Maryland R. R., Mr. J. Q. Barlow, chief engineer; Mr. Virgil G. Bogue, consulting engineer. It was built and erected by the Pennsylvania Steel Co., Mr. J. V. W. Reynders superintendent of the Bridge and Construction Department, and Mr. F. W. Cohen engineer of erection, and Mr. L. N. Gross superintendent of erection.

Sliding Hillsides.

Sliding hillsides have caused much trouble at Covington, Ky., to the water main laid in them almost its entire distance between the Licking River and the distributing reservoirs. The slipping of the earth frequently ruptures the joints and occasionally breaks the pipe. The main crosses a river on a railway bridge, and its vibrations and temperature changes produce frequent leaks. Under these conditions it is not surprising that the pipe line has been causing trouble, or that the 10-in. emergency main connecting the Covington and Newport works is put into frequent use. The supply obtained in this way is not at all adequate and simply prevents a water famine in Covington. Mr. George Hornung investigated the subject a couple of months ago, and advised either the construction of an additional distributing reservoir of 30,000,000 gal. capacity or the laying of a larger emergency main between Covington and Newport. In this connection it might be added that there are few localities in the country where sliding earth causes more trouble than in the Cincinnati district, and it is to be regretted that a compilation of local data on the subject has never been made.

A FIRE-TUBE SUPERHEATER of the Heizmann type was tested quite thoroughly in a manner described in detail in the "Zeitschrift" of the Society of German Engineers. This heater is described as looking like a large plate, and has a series of very short tubes through which the fire gases pass. The steam passes through the plate at right angles to these tubes. The tests show that those parts of the superheater in which the transmission of heat is produced by conductivity as well as by direct radiation are considerably more effective than those parts where no radiation of heat takes place, and the transmission of heat due to conductivity alone does not apparently depend very much on the temperature of the fire gases, but to a great extent on their speed.

Test of a 1,000-Kw. Turbo-Generator under Service Conditions.

In The Engineering Record of June 24 there was printed a review of the present status of steam turbines in America, submitted to the National Electric Light Association by Messrs. W. C. L. Eglin, A. C. Dunham, I. E. Moultrop, George W. Cato and J. D. Andrew. This committee appointed Messrs. Charles H. Parker, of Boston, and Walter Goodenough, of New York, as engineers for the considerable number of service-conditions tests that were made at various plants. There has been some dispute concerning the accuracy of the instruments used in all of these investigations except one. This trial, which has been pronounced satisfactory by the representative of the turbine builder present during the run, was made on April 6 at the plant of the Hartford Electric Light Co.

This turbine is a 1,000-kw. Parsons type of turbine, built by the Westinghouse Machine Co., and runs at 1,800 r.p.m. The generator is a 60-cycle, 2-phase, 2,400-volt alternator, built by the Westinghouse Electric & Mfg. Co. The condenser was built by the Alberger Condenser Co., and has 6,000 sq. ft. of cooling surface, and is of the counter-current 3-pass type, with steam entering at the bottom, and the condensed water taken from a hot well cast in the bottom of the condenser and with the dry-air pump suction taken from the top of the condenser. This condenser, with its dry-air pump and circulating pump, is intended to handle the exhaust steam from two turbines of the size noted above. The circulating pump was built by the Alberger Co., and is a 14-in., vertical-axis, centrifugal pump driven by a vertical Westinghouse type "C" constant-speed induction motor running at 580 r.p.m. and rated at 50 horse-power. The dry-air pump is an Alberger two-stage pump with cylinders 8, 18, 18 and 24-inch stroke. The wet-air pump was also built by the Alberger Co., and is a horizontal duplex pump 6 x 5.5 x 6 in., with 4-in. suction and 3-in. discharge.

TEST OF 1,000-KW. WESTINGHOUSE-PARSONS TURBINE.

Time, minutes	60	60	60	60	60	60	60	30
Kilowatts	1546.4	1219.3	1047.6	1071.5	735.8	463.0	271.8	00
Superheat, deg	108.0	92.4	76.0	77.7	72.9	62.1	49.2	24.5
Absolute pressure, in	2.19	1.70	1.57	1.70	1.21	1.01	0.88	1.43
Gross water hourly, lb	30,172	23,933	20,900	21,281	16,000	11,559	8,968	3,596
Water seal of end bearing, lb	939	852	796.5	765	829.5	911	951	912
Steam from by-pass valve chest, lb	114.5	106.5	68	75	43.5	23	19	00
Net water hourly, lb	29,347.5	23,187.5	20,171.5	20,591	15,214	10,671	8,036	2,684
Water per kilowatt-hour, lb	18.98	19.02	19.26	19.22	20.68	23.04	29.56	——
Steam pressure at throttle, lb	135.0	137.1	137.2	137.7	138.6	140.7	146.3	144.7

The exhaust from the turbine is taken out of the bottom of the low pressure and runs down vertically to a lead which brings the exhaust horizontally into the bottom of the condenser. The dry-air pump is situated directly above the condenser, with as short a connection as possible to the pump. There is no air cooler on the dry-air suction, as the air is taken out of the coldest part of the condenser. The wet-vacuum pump is situated alongside of the condenser immediately below it, and connected to the hot well with a short run of pipe.

Operation of Turbine.—Throughout the time of test the turbine operated very quietly and without any appreciable vibration through all the loads, from no load to 50 per cent. overload. The operating engineer devoted the principal portion of his time to the attention of the auxiliaries. The testing engineers endeavored to impress upon the Hartford Electric Light Co. that the test of this turbine was to be done under strictly normal conditions of running.

In this station, from the statements of the operating people, they usually take anywhere from 20 minutes to half an hour to put the turbine into load, and that they seem to think it good policy on their part always to take this time. The Westinghouse representatives claim that a good average time under operating condition should be 15 minutes, and that they have in an emergency got the turbine in in seven minutes.

Operation of Auxiliaries.—The auxiliaries for the turbine in this plant require the principal attention of the one engineer, the wet-vacuum pump requiring attention in starting up, in order that same may not become air-bound. During the running of the turbine the dry-air pump has to be watched at very high vacuums on account of apparently indifferent regulation at those points. In this connection, however, it must be remembered that this one dry-air pump is intended to take care of two turbines of this size. The station people report that they have considerable trouble with carbonization of oil in their second-stage cylinder of the dry-air pump, to the extent of partially closing air ports into the cylinder and making the air relief valves stick open.

Loads.—The loads on the turbine at all times were purely commercial in the respect that the current generated was used for light and motor driving. The testing engineers were favored as regards steadiness of load at this plant by the fact that while testing, all the current generated for this company, with the exception of this station, was furnished by two water power plants working in parallel with this station and governed by a Lombard governor.

The condenser was tested for leakage and found to be absolutely tight. There were two leakage tests—one before beginning the test and one after. The steam gauges were tested as warm as possible several times through the test. The thermometers were compared and calibrated before the beginning of the test and after the same.

Testing Apparatus.—The electrical testing apparatus consisted of two wattmeters and two voltmeters, one set on each phase, with their respective transformers. These instruments were brought from New York in the hands of the assistants on the test, and after returning to New York from Hartford they and their transformers were sent to the Electrical Testing Laboratories of New York for calibration. The calibrations have been applied to the readings for kilowatts.

The steam apparatus consisted of carefully standardized thermometers placed in the steam chest in front of the admission valve and in the exhaust pipe on the horizontal leg leading to the condenser. There were also steam gauges on the steam pipe close to the turbine and on the first stage of the turbine, and a mercury column on the exhaust nozzle close to the turbine casing. Barometric readings were obtained from the Weather Bureau at Hartford and corrected for the level of the station, and the corrected reading applied to the readings of the mercury column to give absolute pressure.

Water-weighing apparatus consisted of two weigh tanks on two platform scales with a receiving tank below. The water was led to these tanks with valves so placed that it could be directed at will to either one tank or the other. Standard test weights were obtained in the city of Hartford, and the scales tested and found to be correct.

Tests.—In all, eleven tests were run. It was the desire of the Hartford Electric Light Co. that all tests should be made within twenty-four hours. The conditions in this plant were such that variations at will of the superheat could not be made, and it will be seen from the records of the test, that the superheat followed the line of load, as also did the vacuum and steam pressure. This quality in the steam pressure and superheat is due to the fact that there were only two boilers in the plant, and they were connected directly with the superheaters and in such a manner that they could not be by-passed in order to mix saturated steam with the superheated steam.

Each test was of one hour's duration, with the exception of the no-load test, which was half an hour. This turbine at the time of the test had not as yet been covered with non-conducting material, although the middle lagging was in place about the turbine.

Gas Engine Terminology.

Gas engine terminology has been the subject of some interesting communications to the "Zeitschrift" of the Society of German Engineers. The subject was brought up incidentally in an article by E. Meyer describing a test of a 500-h.p. gas engine of the Oechelhäuser type. It was originally provided with a double-acting pump, one side for gas and the other for air, but it was later modified by using both sides for air and fitting up a spiral gas pump. Meyer used the following notation: A = indicated horse-power in engine cylinder; B = indicated horse-power in two pump cylinders; C = A — B = indicated horse-power of gas engine; D = indicated horse-power of blower driven by the gas engine; D ÷ C = mechanical efficiency of the set. This was disputed by Prof. A. Riedler, who asserted that the indicated horse-power of the engine was A and the mechanical efficiency of the set should be D ÷ A. The question, in other words, was whether the work done by the charging pumps is to be reckoned as a thermodynamic or mechanical loss. Prof. Riedler alone held the latter opinion, while against him were A. Stodola, R. Schöttler, E. Meyer, L. Ehrhardt and A. Wagener. The general opinion seems to be that where the pump does merely displacement work, this should be reckoned as a mechanical loss, and that where, as in the four-stroke gas engine, in which the engine cylinder acts as a pump, the pump does compression work, this should be reckoned as a thermodynamic loss. Where, as in Clerk's engine, the pump does both displacement and compression work, there must be some arbitrary decision, which will be universally adopted, so that the meaning of the terms "indicated horse-power" and "mechanical efficiency" will be definitely fixed for all gas engines.

Book Notes.

The transporter bridge over the Duluth ship canal is described in a well-illustrated pamphlet entitled "The Duluth Aerial Ferry Bridge," copies of which can doubtless be obtained from the U. S. Engineer Officer in that city. The canal was used in 1904 by 6,573 vessels having a nominal tonnage of 11,150,905, and as this traffic took place in 217 days, it is self-evident that any bridge over the canal had to be free from all obstruction to navigation. Accordingly, steel towers were erected on each side of the canal and connected by a truss bridge having a clearance of 135 ft. above the ordinary stage of Lake Superior. The clear span is 393¾ ft. This truss carries a four-rail track on which runs a car hauled back and forth by a fixed cable and two 40-h.p. electric motors. The platform hung from this car is 34x50 ft. The superstructure was designed by Mr. C. A. P. Turner as engineer for the Modern Structural Steel Co., of Waukesha, and weighs about 700 tons. The bridge was erected as a cantilever from the tops of the two towers.

City officials who are struggling with the problem of garbage disposal will find a large amount of useful information in the little pamphlet entitled "Notes on British Refuse Destructors," written by Mr. M. N. Baker, president of the Board of Health of Montclair, N. J., and published by "Engineering News," New York. Last year the author visited a number of British and Continental cities in the interests of that journal and took occasion of the presence of a disposal plant in any city where he stopped to investigate the methods and equipment in use. He gives the results of his observations in a clear and instructive way. A good deal of data that it would be highly valuable to possess, such as the calorific values of the different sorts of refuse, is not stated because, probably, it has never been ascertained with any degree of accuracy. The fact brought out most clearly by the author is that the cremation of refuse in Great Britain is far more successful than here, and he seems to hold the idea that it is because not enough really careful expert study has been paid to the subject in the United States and the American furnaces are not so well managed as those abroad. This is the opinion generally held by those engineers who have examined the subject with more than superficial attention, and it is for this reason that the pamphlet will be particularly worth the attention of our public officers entrusted with garbage disposal problems.

There are a good many students of political and economical questions in the country who believe that the most serious problem facing us at the present time is that of what to do in or with the Philippines. All information concerning the conditions there is of particular importance, for now that we are responsible for the administration of a territory on the other side of the globe, alien in its habits of life and thought to the older parts of the United States, it is highly incumbent on us to study the people and their needs more carefully than were they more closely related to us by blood and by tradition. A very interesting pamphlet bearing on the subject of the labor conditions in the islands has been written by Dr. Victor S. Clark for the May "Bulletin" of the Bureau of Labor of the Department of Commerce and Labor. It reviews Philippine history, government, general statistics, unskilled and skilled labor conditions, commerce and transportation, standard and cost of living, labor organizations, benefit societies, legislation, education, Chinese immigration and other subjects as they affect the labor problem in general, and concludes with an appendix giving the wages paid in different occupations. The following quotation from the introductory part of the report deserves careful consideration from those who think that the subject is without importance. "So primitive is the industrial condition of the Philippines that the wage system has hardly begun to exist in most parts of the country, slavery or an almost equivalent system of peonage is the common condition of agricultural and domestic service, and the most imminent problem the islands have to face is how to effect a speedy and ready transition from a social state where many workers are in quasi-servitude, to one where they are industrially independent. The motive for such a change is not primarily the happiness of the working people, for they are possibly as contented and possess as satisfactory an adjustment of material resources to their physical and intellectual demands as they would in a more advanced state of society. But the change is necessary for the development of the natural resources of the country with native labor, and it is a condition precedent to the successful operation of the form of government that we design to set up in the islands. The primary problem in the Philippines is the labor problem." The Engineering Record is not a judge of the correctness of the author's data or his deductions from them, but the report is written in a style that sustains the reader's interest and the reputation of the Bureau which publishes it is an assurance of the reasonable accuracy of the statements.

Moody's Manual of Railroads and Corporation Securities. Sixth annual number, 1905. New York, Moody Publishing Co.; cloth, 8vo, 2,600 pp., $10.

This manual has become a necessity in the office of any firm or individual interested in financial affairs of any magnitude, and the new edition is so much more comprehensive than those of previous years that its value is greatly enhanced. The alphabetical index is a really remarkable piece of work, and so complete that even the most ignorant office boy ought to be able with its assistance to find for his employer the leading facts concerning any corporation mentioned in the volume. There is also a geographical index by which the leading companies in every important city in the country can be learned in a moment. Another list gives the full roll of members in 25 stock exchanges in American and Canadian cities.

The statements of the public debts of the United States and the several individual States, of Canada, Mexico and foreign countries is of growing importance, as American investors are more and more inclined to buy such classes of bonds. The section devoted to steam railroads is 80 per cent. larger than the same section in the volume for last year and contains notes of roads under construction as well as those operated. The section devoted to electric traction companies is 56 per cent. larger than that of last year, the section on gas and electric companies 49 per cent., the section on private water works 80 per cent., the section on telegraph and telephone companies 32 per cent., the section on industrial and miscellaneous companies 21 per cent., the section on mining and oil companies 48 per cent., and the section on banks, trust companies and other financial institutions 90 per cent. This record of growth in a work so well and favorably known is an indication of the publishers' energy in making the book as complete and exhaustive as the limits of a single volume permit.

Neuere Turbinenanlagen. By Wilhelm Wagenbach. Berlin, Julius Springer; cloth, 4to, 127 pp., 54 folding plates.

One of the most useful books to engineers engaged in hydraulic power plant designs is the report by Prof. E. Reichel to the Society of German Engineers on turbine construction at the 1900 Paris Exposition. This report has been out of print for some time, and as the demand for it is still great, Prof. Reichel requested Mr. Wagenbach to bring it down to date. This has been done very satisfactorily, and the result is a well-arranged and profusely illustrated work, free from theoretical impracticabilities. The general development of turbines is first outlined and then the various types in common use are explained. This is followed by descriptions of installations of turbines and impulse wheels in many countries. The selection of examples has not been made for the purpose of filling up the text with a lot of information of little use, but in order to illustrate various types of construction or setting not shown by other plants. Finally the regulation of turbines is discussed at considerable length.

It is safe to say that the book contains more information concerning the design and installation of such equipment of the latest type than any other that has appeared to date. A special feature is the great number of excellent engravings, which are employed wherever illustrations serve the author's purpose better than text. In consequence, the book contains the plans of a large number of the leading hydraulic power plants of the world, recently constructed, so that even to the reader whose knowledge of German is limited the book has much value.

Letters to the Editors.

Low Pulling Portland Cements.

Sir: I have read with interest the article on "Low Pulling Portland Cements," by Mr. W. A. Aiken, which appeared in your issue of July 8. The article is a resume of inspection work done, involving over 2,250,000 bbls. of cement, with tests extending to three years, under specifications requiring a minimum increase of 15 per cent. in neat strength and 25 per cent. in sand strength in 28 days' tests over 7 days' tests. The writer remarks in the course of the article that "an examination of the results of the table . . . . corroborates the wisdom of the original requirements," and that "nothing in the work of the Department of Inspection has yet shown anything to warrant the slightest recession from the Commissioners' original position when the ruling, first made from actual experience with some 100,000 bbls. of accepted cement, corroborates the theory and resulted in the formal promulgation of the specification requirements for a percentage of strength increase." And yet, an examination of the figures quoted, figures bound to carry most decided weight from the vast number of tests made on the enormous bulk of material examined, is the most positive evidence yet presented of the injustice which actually resulted in these cases, and is likely to result in all cases, by an adherence to the "percentage of strength increase" specification quoted. Cement in work is, of course, never used neat, the behavior with sand being the only true criterion of what can be expected of the cement in actual work; in fact, Mr. Aiken, himself, in the course of the same article refers to "sand results, which, after all, are the most important factors in determining a cement's value."

Quoting from the article, the resumé on all the accepted cement and all the rejected cement of these 2,500,000 bbls. show results as follows:

Long-Time Tests of 1: 2 Portland Cement Mortars.

Age.	Accepted cement.	Cement rejected for poor gain at 28 days.
7 days	404	434
28 days	525	519
3 months	568	538
6 months	549	511
1 year	552	508
2 years	523	505
3 years	492	520

These figures show conclusively that the "percentage of strength increase" specification resulted in rejecting first-class material, better cement, in fact, than that accepted, the strength of the rejected cement at the end of three years being 28 lb. greater than the strength of that accepted. The cement accepted showed the decided falling off, at the end of three years of 33 lb. from its strength at 28 days, which latter strength in a manner controlled its acceptance, while the cement which was rejected showed no falling off at the end of three years; in fact, recorded a slight increase. Reduced to percentages, the accepted cement, while making its required increase of 25 per cent. in the short-time period of 28 days, lost 6.3 per cent. of this strength at the end of three years; the rejected cement, while failing to make the required 25 per cent. increase in the short-time period of 28 days, registered a small percentage gain at the end of three years and was then about 6 per cent. stronger than the accepted material. After the three-month period the maximum falling off in strength of the rejected material at any time during the entire three years was only 33 lb., while the accepted cement, during the same period, showed a maximum falling off in strength of considerably more than twice this, or 76 lb.

The publication of comprehensive data of this kind, covering as they do, thousands of tests, and the careful analysis of the figures recorded, cannot fail to impress engineers, eventually, with the fallacy of the conclusions sometimes drawn from a comparison of strength tests at the 28-day and the 7-day periods.

Very truly yours, Bernard Enright.
South Bethlehem, July 20.

Connecting New York and Brooklyn Water Mains.

Sir: In view of the frequently threatened water famine in Brooklyn, which again appears to be imminent, it seems a little strange that no connection has ever been made between the Croton and Ridgewood systems by which Manhattan and Brooklyn could help each other out in such emergencies, which are never likely to be simultaneous. This was, to my mind, one strong reason for consolidation and influenced my vote, and perhaps that of others, for that measure. The expense of a tunnel or of submerged pipes would be small in comparison with the comfort and security to be gained. Is there any other objection?

Cordially yours, H. W. Brinckerhoff.
New York, July 19.

Estimates and Contracts Involving Contingencies.

Sir: The outcome of the investigation of the facts in connection with the contract and specifications of the Philadelphia filtration plant is of interest. The press of that city has recently charged the engineer with permitting the contractor to defraud the city out of one-third of a million of dollars by omitting concrete from the bottom of the clear water basin, which, by a "saving clause" in the contract and specifications, should, under certain contingencies, have been put into the work without cost to the city.

Without entering into the merits or demerits of the fraudulent nature of the charges, the writer thinks it timely to point out the lack of wisdom, to say the least, of inserting in contracts and specifications clauses similar to the one alleged to exist in the Philadelphia contract. In the contract and specifications in question it was provided that if, when the depth shown upon the plan for the bottom of the basin was reached, an unsuitable material for the bottom should be found, the contractor should then excavate to a depth satisfactory to the engineer and refill the excavation thus made with concrete without cost to the city. To protect himself against such a clause, the intelligent contractor must, of necessity, increase his bid beyond what the work may reasonably be worth, thus frequently losing all chances of securing the work.

In the writer's judgment this clause in the Philadelphia specifications is not one whit worse than the clauses which can be found in most contracts and specifications, in which the engineer clothes himself with arbitrary powers in the one instance, but in the next cuts himself off from the possibility of paying for unforeseen difficulties which may develop during the progress of the work.

It seems, from a perusal of many specifications, as if engineers were afraid to trust themselves with the responsibility of determining the value of such unforescen work, but desired, by saving clauses, to avoid criticism which might result from the overrunning of their estimates; even if this overrunning is but just payment to the contractor for what the engineers personally know he is honestly entitled to.

If the work is of such a nature that full data concerning it can be secured in advance, and such data are secured and furnished to the contractor, the matter is entirely different. But when full data are not furnished, as is the case in the major portion of public work of certain kinds, the writer contends that it is dishonest to award a contract for a lump sum figure when that sum may be wide of the true value of the work. For if, in letting the contract, the engineer knows that the work may cost the contractor considerably more than he is to be paid, it is clearly an attempt to get something for nothing, which condition oftentimes results disastrously, not alone to the contractor but to all parties in interest. The intelligent contractor under such circumstances will bid high enough to safeguard himself against all possible contingencies, and, therefore, if these contingencies are not encountered the engineer's client is mulcted for the difference between the high bid and the actual value of the work.

When engineers are willing to assume squarely the responsibility of an increase in the cost of the work over their estimate, if the character of the work warrants it (where full and complete data are not and cannot be secured before the bidding), there will be more intelligent bidding and less desire to scamp work on the part of the not-over scrupulous contractor, who finds himself trapped by reason of vague, indefinite and dishonest clauses in the contract and specifications.

While the contractors are apparently more often the losers in these cases, the engineers themselves, in the long run, are the greater losers by reason of the lack of confidence and the cheapened regard in which they are held.

Very truly, Alexander Potter.
New York, July 15.

Counterweights for Bascules.

Sir: A curious example of how an invention, designed to meet the peculiar conditions surrounding a relatively insignificant matter, may prove to be also the solution of a far more important one, is here presented for the consideration of the readers of The Engineering Record. The problem was that of devising a counterpoise for a folding iron gate for a building now in course of erection in New York City. The gate was required by the specifications to fold back and upward when opened, there being no room to swing the horizontal pieces laterally. In order to obtain the diminishing degree of force needed to counterbalance exactly the mass of the gate when rising to a vertical position against the gate-post, the simple device was suggested of using a string of weights one above the other, which, by coming successively to rest as they descend, gradually reduce the mass of the counterpoise acting on the gate.

It was not until the gate had been constructed and was in successful operation that the idea suggested itself that this device might prove an admirable substitute for the present forms of counterpoise for bascule bridges. Compared with the bulky and elaborate inclined track and sliding weight, or the equally clumsy and still more costly lever counterpoise and pit for same, it will be seen that this idea might have many advantages. The weights could be allowed to descend inside the tower of the bascule bridge, and would be entirely concealed by it. No pit or special form of trunnion need be provided, and the perfection of counterpoise could be secured in direct proportion to the number of weights used. This device is now being presented for the consideration of several bridge building firms, and it seems within the range of possibility that a radical change in bascule bridge design may spring from the simple solution of a folding gate.

Respectfully yours,
John Hawkesworth, C. E.
100 West 80th St., New York.

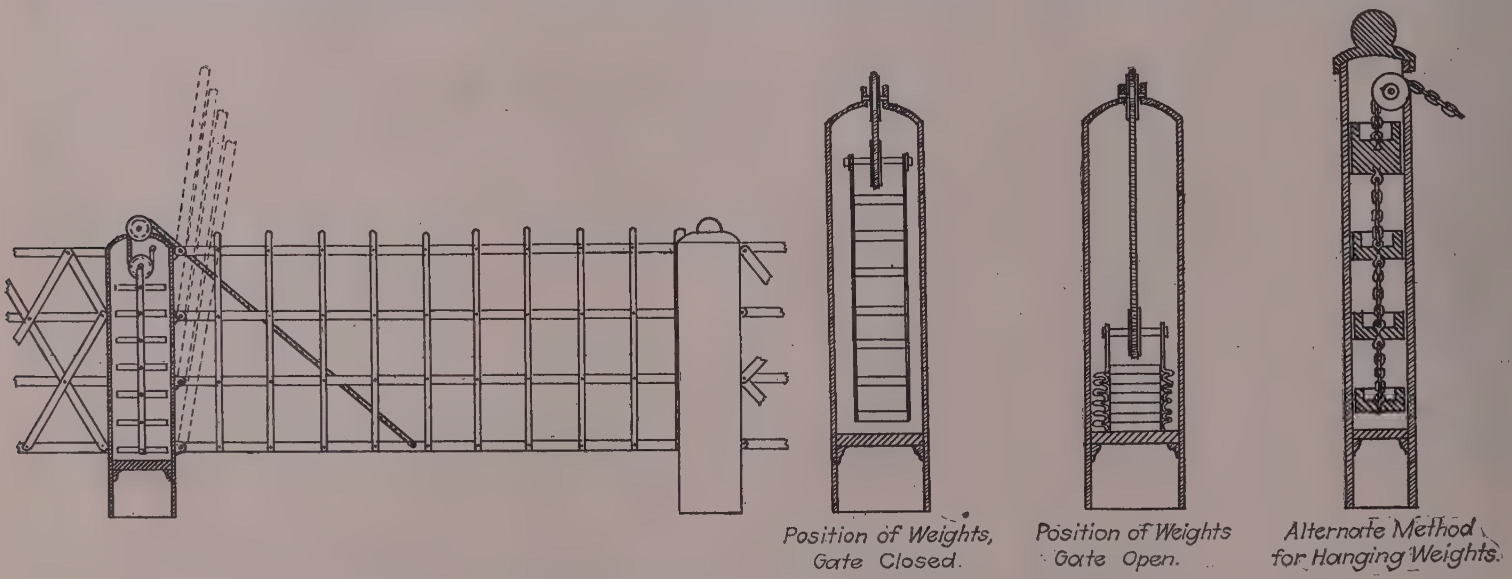

Position of Weights, Gate Closed.
Position of Weights Gate Open.
Alternate Method for Hanging Weights.

Diagram Showing Balancing of Gates by Means of Differential Counterweights.

CURRENT NEWS SUPPLEMENT

JULY 29, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers, Secretary, Chas. Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga. Annual meeting, Chattanooga, Aug. 30-31.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

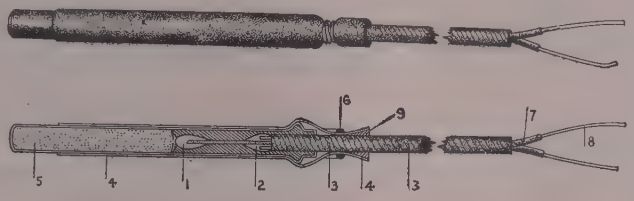
THE GREAT BLAST AT HENDERSONS POINT.

In The Engineering Record of March 23, 1901, there was printed a full account of the work on the dry-dock at Portsmouth, N. H., which John Peirce, of New York, built for the Navy Department. The map of the site, which was published at that time, shows that a large mass of rock obstructed the entrance to the dock, and in 1902 the Navy Department made an arrangement for its removal with the Massachusetts Contracting Co., of which Orlando W. Norcross, of Worcester, Mass., is president. The work involved the removal of a mass of rock projecting into the river 300 to 400 ft. and covering an area of about 4½ acres, to a depth of 35 ft. below low water. Since the beginning of operations, under the direction of Mr. O. A. Foster, the company's superintendent, about 194,000 cu. yd. of ledge have been taken out in the dry and an area of about 30 acres of filled land added to the navy yard by the excavated material. About 35,000 cu. yd. were taken out by the blast.

A coffer dam, 1,300 ft. long and 16 ft. wide, to resist 25 ft. of water, was built around the edge of the area. Rangers were fitted and bolted directly to the ledge under water, and each plank fitted to the rock and bolted to these rangers. The dam was puddled with clay. The entire area was then excavated in the dry, leaving a shell of rock directly under the coffer dam, which was finally blow up on July 22. In this outer ring or shell of rock were 30 holes 4 in. in diameter and 30 to 85 ft. deep, which were loaded with 34¼ tons of dynamite and fire simultaneously. About 100 holes in the coffer dam were also loaded and fired at the same time. The plant required for the work was large. In the power house were three boilers of a total rating of 485 h.-p. and three Laidlow-Dunn-Gordon compressors, one of 1,160 ft. capacity and two of 830 ft. capacity each. Fourteen Ingersoll-Sergeant drills with 3½ in. cylinders and five with 5½ in. cylinders were used in cutting the holes. One 8-in. and two 10-in. Lawrence centrifugal pumps were employed for drainage purposes. Six hoisting engines were used and several more were kept on hand for emergency purposes. For handling the spoil about a mile of track, two locomotives and two trains of cars were employed, and various buildings were erected for shops, storage and offices. A ferryboat was also purchased for transferring materials and men, the number of the latter running up to about 475 at times.

The dynamite employed was prepared specially for the work by the National Powder Co., of New York, and in each charge were three exploders made for this blast by the Star Electric Fuse Works, of Wilkesbarre, Pa. The electrical wiring of the holes was done by Mr. Thomas Flanagan and required about 10 miles of wire. After all the wiring was completed water was let into the three-acre excavation so as to load the site properly for the blast.

A great deal of the success depended on the exploders, which are shown in the accompanying cuts. In these illustration 1 is the matchhead with a platinum wire bridge, 2 are the soldering spots, connecting the matchhead to the fuse wires; 3 is a piece of No. 20 duplex rubber wire wound with heavily saturated double cotton insulation; 4 is a piece of rubber hose pushed over the finished exploder to make it absolutely water-tight; 5 is the charge of 46.3 grains of fulminate of mercury in a copper shell; 6 is a bare copper wire for tying the rubber hose tightly about the fuse wire; 7 is the rubber insulation on the wires; 8 are the bare No. 20 tinned copper wires, and 9 is a waterproofing composition. To fire these exploders a current of 110 volts and 75 amperes was used. The 900 exploders were divided into groups of 20 each in which the exploders were joined in series, and each of these 45 series was joined in parallel to the main wires so that each exploder received 1½ amperes. The firing was done without the slightest hitch of any sort. The makers of these exploders lay particular stress on the merits of the waterproofing of the caps. The sulphur cement which holds the wires in the cap is covered with a waterproof compound and every air space in the cement plug is closed. As a special additional precaution a piece of rubber hose is fixed over the cap and tied with a fine wire around the fuse leads so that no water can touch the sulphur cement. Finally the whole exploder is coated with a waterproofing compound.



EXPLODERS USED IN THE HENDERSONS POINT BLAST.

HEAT IN THE NEW YORK SUBWAY.

In response to numerous inquiries concerning the cause of the unusual heat in the New York Subway lately, an extract from an official report on the subject, by Chief Engineer George S. Rice, of the Rapid Transit Railroad Commission, is given below:

"This question of ventilation has been the subject of study by this department for a number of years, and careful observations have been made on different parts of the Subway, as it was foreseen that certain contingencies might arise, and we had anticipated what the conditions would be when the Subway was to be in operation. During the winter the average temperature of the tunnel has been about 40° Fahr., but in summer, of course, it is much higher on account of the proximity of the structure to the heated surface of the street.

"Since the operation of the road there has been an almost uniform increase in temperature, due to the heat generated by the motors, as the trains increased in number and a larger number of passengers were carried. In the winter time this rise in temperature is not so noticeable, and the problem which now confronts the engineers is to provide some means by which this air can be readily changed at points where the greatest amount of trouble is experienced. This can be done by putting in fans at certain places along the line of the work, and in some cases placing them in the duct manholes which are at frequent intervals along the line of the road. It will, of course, be necessary to take each separate station or section of the Subway by itself and evolve a method of proper ventilation. It is not so much a question of the kind of ventilation to be adopted as it is to arrange for the proper location of the fans, and this methd of treatment, to effect the necessary change in the air, will, I think, prove the most economical and feasible. The running of trains at more frequent intervals may be compared to running, during the busy hours, so many heated stoves through the Subway, and if the air is renewed in the manner suggested relief will be afforded. The odor which is so apparent along the line of the Subway, so far as we can ascertain, is due entirely to the oil used for lubricating the moving parts of the trains."

CONCRETE BLOCK MACHINERY MANUFACTURERS' ASSOCIATION.

On June 27 a number of makers of cement block machinery met in Chicago and organized the Concrete Block Machinery Manufacturers' Association of the United States. Those present were Sid L. Wiltse, Jackson, Mich.; C. C. Huston, Columbus, O.; Noyes F. Palmer, Brooklyn, N. Y.; J. F. Angell, Columbus, O.; C. W. Stevens, Harvey, Ill.; O. U. Miracle, Minneapolis, Minn.; A. L. Goetzmann, Chicago, Ill.; S. J. Young, Jackson, Mich.; P. B. Miles, Jackson, Mich.; Frank L. Dykema, Grand Rapids, Mich.; James W. Shone, Rochester, N. Y.; Ernest McCullough, Chicago, Ill.; J. P. Sherer, Milwaukee, Wis.. Mentor Wetzstein, South Bend, Ind.; John Miller, Minneapolis, Minn.; E. C. Harter, Detroit, Mich.; R. J. Schwab, Milwaukee, Wis.; W. J. Scoutt, Chicago, Ill.; J. J Ferguson, Denver, Colo; and N. J. Morehouse, Cedar Rapids, Ia. Mr. Wiltse was made permanent chairman and Mr. Miracle secretary of the meeting. Various committees were appointed to assist in perfecting a permanent organization, and at a session on the following day a constitution was adopted which confines membership to "a company, firm or individual engaged in the manufacture of machines, molds or processes for the manufacture of cement or concrete building blocks." The officers for the first year are: President J. F. Angell, Columbus, O.; vice-president, O. U. Miracle, Minneapolis, Minn.; secretary, Sid L. Wiltse, Jackson, Mich.; treasurer, C. C. Huston, Columbus, O.

The first paper read was by Mr. Miracle and discussed the relations of the machine maker to the public. It was succeeded by an informal discussion on the manufacture of concrete blocks, in which Messrs. Morehouse, Harter, Krautnau, Palmer, Stevens, Scoutt and Gotezmann took part. Mr. Krautnau dwelt strongly on the advantages of a waterproof cement for facing blocks, while Messrs. Stevens and Dykema spoke mainly on cast blocks. Mr. Dykema then read a paper on the architecture of concrete buildings, in which he protested against the custom of trying to make the blocks resemble rough stone. He pointed out that most architects used dressed stone, and suggested that the makers of blocks would strengthen their position were they to search for those shapes and surfaces which give the most satisfactory effects in concrete. The material was of enough importance to be treated for its own self rather than as an imitation of something else.

Following this Mr. Palmer, of Brooklyn, one of the pioneer block machine makers, gave an interesting informal talk on his experiences in the business, and was followed by Mr. Levi P. Normandin, of Jackson, Mich., whose subject was the block industry. He did not believe it made much difference whether a block was made with the face down or on the sound, and in any case he thought it could not be made strictly waterproof. On the other hand, by the selection of good materials in the first place, then mixing them properly, and finally making the block well, he was confident that a block would be produced that would improve with age. Seasoning was very important. Mr. Angell then read a paper on the terms of sale of concrete block machinery, which he believed were often altogether wrong and sometimes led to a wrong impression of the condition of the block industry. After the discussion on this paper was finished, the convention adjourned for a sail on the Lake at the invitation of the owners of the "National Builder."

On the next morning, the meeting was opened with a paper on concrete block insurance, by Mr. Wiltse, who has been doing a great deal to get this subject in a satisfactory condition. At the close of the paper a motion was made to appoint a committee to draft standard specifications for blocks and to co-operate with the insurance people in this matter. This motion aroused a great deal of discussion, but it was finally carried and Messrs. Miracle, Sherer, Dykema, Wiltse and Miles were appointed on the committee. In the course of the discussion Mr. E. T. Cairns, chairman of the Cement Construction Committee of the

National Fire Protection Association, made an address of some length concerning the views of that committee and the work it was doing to determine the fire-resisting properties of concrete in mass and in blocks. After the transaction of business matters, Mr. Sherer gave a talk on coloring concrete blocks, a subject which has by no means received the degree of attention as yet which it deserves. The meeting was brought to a close with a paper on the architect's part in the block industry.

SUCTION GAS PRODUCER IN A NEWARK SHOP.

Suction gas producer plants are being more and more introduced with great success in this country on account of their simple working and economy in running and maintenance expenses. Such a producer, shown in the cut, is working successfully in the machine shop of the F. W. Horstmann Co., East Newark, N. J. This shop formerly used illuminating gas in connection with a gas engine. The new plant, which was built by Dr. Oskar Nagel of New York City, is working under the following guarantee, the development of 1 b.h.p. per hour from 1-¼ lb. of anthracite pea on full load, 1-1/3 lb. on three-quarters load, and 1-½ lb. on half load.

The plant has a capacity of 20 horse-power and consists of a hand blower, a producer with an evaporator on its top, and a scrubber. The overflow water-pot which belongs to the plant is in the pit between the producer and the scrubber, and a small equalizing tank is connected on the floor below to the engine, so as to connect the scrubber with the engine. By the sucking action of the engine the air is drawn over the surface of hot water in a water-jacket and saturated with steam, and this saturated mixture of steam and air is drawn through the fuel whereby the producer gas is generated. From the producer, the gas goes through the scrubber, which is filled with coke, and where it is freed from dust and tar by means of water. From the scrubber the gas goes through the equalizer, which is a simple iron drum, to the engine.

This plant is provided with a hopper which is sufficiently large to contain fuel for the whole working-day, so that no refilling of coal is required during the working hours. After shutting down over night, the lower door is kept somewhat open and also the valve leading to the flue, so as to keep up a little draft and maintain the fire. In the morning, before starting up, the fire is cleaned and the hopper filled with coal. The fire is next blown hot for about ten to fifteen minutes by means of the hand blower until the gas is burning well at the test cock, and then the engine is started as usual. During the working-day the plant does not require any attention except cleaning the grate once or twice a day.

A similar plant is working at the elevator of the Stockbridge Elevator Co., Stockbridge, Mich., and is running successfully on a changing load. This company used, until a short time ago, a gasoline engine for developing its power, and has now installed this producer, which works satisfactorily with the engine after the compression in the latter has been increased sufficiently. The saving in both of these plants is said to be such that the first cost of the plant is recovered by the saving in less than one year.

TRADE PUBLICATIONS.

The Morgan continuous gas producer, which was awarded a grand prize at the Louisana Purchase Exposition, is used by 22 American and 16 European works, although a comparatively new apparatus. It was developed by the engineers associated with Mr. Chas. H. Morgan, of Worcester, Mass., in connection with the introduction of continuous heating furnaces to supply hot billets to their well-known continuous rolling mills. It has now been thoroughly tested by five years' experience in heating and melting operations, and the makers, the Morgan Construction Co., 40 Exchange Place, New York, are now ready to introduce it extensively. They have just issued a book describing and illustrating it fully and containing a large amount of useful information concerning producer gas, including the results of some surprisingly good tests by Robt. W. Hunt & Co.

The properties of steel containing 3 to 45 per cent. of nickel vary so greatly that nickel steel is now used for an extraordinary number of purposes. The International Nickel Co., 43 Exchange Place, New York, has recently published a list of these uses of the material, which will doubtless interest many manufacturers who are having difficulty in securing steel of a quality adapted for special work.

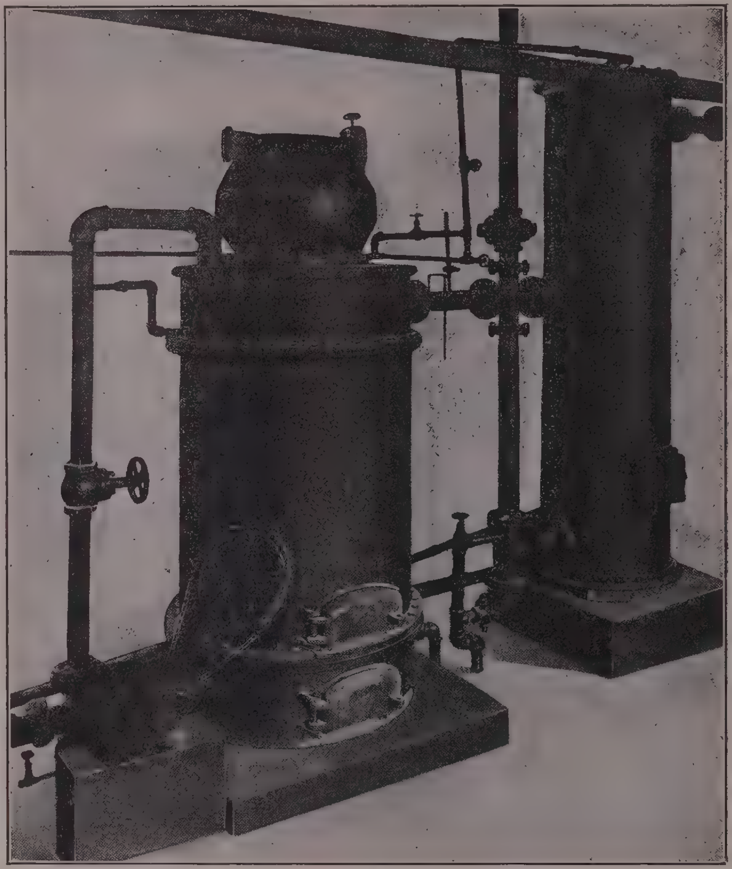
In the last 17 years Warren Webster & Co., Camden, N. J., have developed a large number of specialties for heating work. These include open feed-water heaters of several types and for various classes of water supplies, steam and oil separators of various patterns, expansion joints, preference valves, relief valves, multiple unit headers, vacuum governors, sight glasses, thermostatic traps, atmospheric check valves, dirt strainers, storage tanks and suction strainers. A brief description of the uses of each of these is given in a 16-page folder.

The Crocker-Wheeler Co., Ampere, N. J., has issued in its bulletin 55 a description of a line of small generators for direct connection to steam and gas engines for small isolated plants. They range in capacity from 1½ to 28 kw. and their dimensions are fully stated in the catalogue.

The Allis-Chalmers Co., Milwaukee, has reprinted in attractive form, with excellent illustrations, the paper on gold milling in the Black Hills which Prof. H. O. Hoffman, of the Dakota School of Mines, read before the American Institute of Mining Engineers. The paper describes the equipment, operation and results of some of the most noted stamp mills in the country.

The Electro-Dynamic Co., Bayonne, N. J., has made two valuable additions to its series of circulars. No. 13 is a discussion of the advantages of individual motor-driven machine tools and explains the special usefulness of the inter-pole variable speed motor in securing the maximum economy in shop work. No. 14 is a complete description of the construction and characteristics of this type of motors. Efficiency, speed and torque curves, dimensioned diagrams of various styles of the Inter-pole machine, and illustrations of its leading parts are given. One of the illustrations shows a 3-h.p. motor driving a radial drill in the shop of the Philadelphia Rapid Transit Co., where a 550-volt current is employed.

The Northern Engineering Works, Detroit, Mich., have published a 100-page book profusely illustrated, concerning the great variety of cranes they now build. Electric cranes with one to four motors, using either direct or alternating-current, transfer tables, trolley hoists and overhead track systems, electric chain hoists, air hoists, hand-power cranes, jib cranes and locomotive cranes in great variety are illustrated, and views of many leading American industrial works using them are given.


SUCTION PRODUCER IN SHOPS OF F. W. HORSTMANN CO., NEWARK, N. J.

One of the most interesting statements of the present field of usefulness of electricity that has appeared in some time is given in the pamphlet prepared by the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., for distribution at the Lewis and Clark Exposition. It is a beautifully published explanation of the latest developments in the art, and, while it is primarily devoted to promoting the interests of a single company, the information is fully equal in quality and interest to the average magazine article.

BUSINESS NOTES.

The Power Specialty Co., New York, reports during the past few months a large number of orders for superheaters, among them being equipments for the Louisville Water Works; Ridgewood Pumping Station, Brooklyn; Wilmington, Del., Water Works; Milwaukee Water Works; Sears-Roebuck & Co.; Mandel Brothers; Western Cold Storage Co.; Allen B. Wrisley Co., Chicago; Little Rock Railway Co.; Philadelphia Electric Co.; Terre Haute Traction Co.; Wheeling Electric Co.; Nassau Light & Power Co.; Fairmont & Clarksburg Railway Co.; Independent Light, Heat & Power Co., El Paso, Tex.; Pfister & Vogel Leather Co., Milwaukee; American Locomotive Works, Schenectady; Acker Process Co., Niagara Falls; Eaton, Cole & Burnham Co., Bridgeport, Conn.; International Harvester Co.; Illinois Steel Co.; Tide Water Oil Co.; U. S. Naval Gun Factory, Washington, D. C. Several of these orders are for equipments of batteries of 6 or 8 boilers of from 400 h. p. The Washington Navy Yard order is for five 300 h. p. superheaters to be attached to B. & W. boilers to give superheat of 125° at 200 lb. pressure. This contract is a duplicate of two others which have already been completed by the Power Specialty Co. for the government at this point and completes the equipment of the 15 boilers in the power house at the Navy Yard.

The Marine Engine & Machine Co., manufacturers of electric elevators, have removed their offices to 126 Liberty St., New York, where they occupy the entire fourth floor. This company has recently secured the following contracts: The Hutchins Building, New York, four direct-connected, electrically controlled elevators; the College of the City of New York, eleven electric elevators; one tandem electric elevator for building of the New Orleans Railways; one electric elevator in the Hartford Building, New York; two electric elevators for the Pennsylvania Railroad Co., Long Island City; one electric elevator for the Willett Realty Co.'s new building, New York, and one automatically controlled residence lift for C. W. Luyster, New York.

The J. G. White Co. interests are attracting much attention in London building circles. They are now putting up an office building for the International Navigation Co. and the new Ritz Hotel, and have recently closed a contract for constructing a fine apartment house adjoining the French Embassy on Knight's Bridge.

The Ryan Construction Co., Indianapolis, has just installed for Geo. S. Cook, Hope, Ind., a 75-kw. electric plant for street and commercial lighting.

Mr. A. A. Low has closed a contract with the Ambursen Hydraulic Construction Co., of Boston, by which the latter will build on his estate at Horse Shoe, N. Y., a reinforced concrete dam, power house, penstocks, about a mile of railway and transmission lines by which the power will be furnished to a saw and planing mill 2 miles distant. The buttresses of the dam will be carried up 5 ft. above the crest and serve as piers for a railway bridge.

The Pittsburg Reduction Co. has placed an order for reinforced concrete upon the Cummings system for a large structure to be erected at their new works, Massena, N. Y.

The Western Wheeled Scraper Co., Aurora, Ill., has completed a large addition in which they have installed a 15-ton, 3-motor, electric traveling crane, made by the Northern Engineering Works, of Detroit.

PERSONAL NOTES.

Mr. Geo. M. Kenyon will occupy offices in the Pioneer Press Bldg., in St. Paul, Minn., after Aug. 1.

Mr. B. H. Warren, of the Allis-Chalmers Co., of Milwaukee, Wis., has returned from a European trip.

Mr. James H. Wright has resigned as city engineer of Anderson, Ind., to accept a position with the Illinois Central R. R.

Lieutenant-Colonel Smith S. Leach, Corps of Engineers, U. S. A., has been detailed as a member of the General Staff.

Mr. Henry Rustin, of Omaha, Nebr., has been appointed chief engineer for the Omaha Water Co., succeeding the late Capt. B. F. Reynolds.

Mr. Hartley W. St. John has resigned as superintendent of the Marion, Ind., water works and Mr. Elkanah Hulley has been appointed to succeed him.

Prof. Charles A. Prosser, superintendent of the New Albany, Ind., public schools, has been appointed superintendent of the Winona Lake, Ind., Technical Institute.

Prof. Thomas F. Nichols, professor of applied mathematics at Hamilton College, has become connected with the engineering department of the New York State Barge Canal.

Major Cassius E. Gillette, Corp of Engineers, U. S. A., and Mr. John M. Maclennan, of Washington, have been retained by the Mayor of Philadelphia to investigate municipal contracts made in that city.

Mr. L. H. Bean, superintendent of underground and overhead work for the Seattle, Wash., Electric Co., has become manager of the Whatcom County, Wash., Railway & Light Co.

Mr. Andrew J. Sprague, president of the Massillon Bridge Co., of Massillon, O., since 1871, died recently at his home in Toledo, O. Mr. Sprague was at one time superintendent of bridges for the Wabash R. R., and was later associated with the Smith Bridge Co.

Prof. E. L. Ohle, of Cleveland, O., has been elected acting professor of steam engineering and head of the department of mechanical engineering of Iowa University, Iowa City, Ia., succeeding Prof. S. M. Woodward, who has resigned to accept a position with the U. S. Reclamation Service on irrigation work in the Southwest.

Mr. J. Waldo Smith has resigned as chief engineer of the Aqueduct Commission of New York City, to become chief engineer to the Commission on Additional Water Supply for New York City. Mr. Walter H. Sears, division engineer of the Aqueduct Commission, will be acting chief engineer pending the appointment of Mr. Smith's successor.

Mr. C. W. Parks, civil engineer, U. S. N., has been detached from the navy yard at Boston, Mass., and ordered to the navy yard at Portsmouth, N. H. Mr. F. Thompson, civil engineer, U. S. N., has been detached from the Norfolk, Va., navy yard and ordered to the navy yard at Boston, Mass. L. E. Gregory, civil engineer, U. S. N., has been detached from the navy yard at Portsmouth and ordered to the navy-yard at Norfolk.

Mr. R. D. Hunter, formerly district manager of the Sullivan Machinery Co., at Denver, has been appointed general sales manager of that company, with headquarters in the Railway Exchange Bldg., Chicago. Mr. W. P. J. Dinsmore, for several years connected with the company's Denver office, succeeds Mr. Hunter as district manager. Mr. Matt. Brodie, formerly of the Pittsburg office of the company, has been appointed local manager of its Salt Lake City branch, with offices in the Keith Bldg.

Mr. B. B. Kelliher, who has been acting chief engineer of the Grand Trunk Pacific Ry. for some time, has been appointed chief engineer. He was born in Ireland in 1862 and was educated at Dublin University. He had considerable experience in railway work in Ireland before coming to the United States in 1886, when he joined the Union Pacific staff. Afterward he joined the Northern Pacific engineering corps. He left the latter in 1896 for a short service with Marcus Daly, and then joined the staff of the Oregon Short Line. In 1903 he became locating engineer of the Denver, Northwestern & Pacific Ry., and the next year joined the Grand Trunk Pacific.

There is a personal matter to be recorded, not because it relates directly to any engineers, but because it throws a strong light on a recent occurrence. Judge Day has resigned from the U. S. Attorney General's office to become comptroller of the Equitable Assurance Co. He was particularly engaged on violations of the Sherman law and has been regarded as the government's mainstay in its investigations concerning illegal rebates and the beef packers' case. His resignation to accept a very lucrative post under one of the most flagrant violators of the rebate laws is attracting no official comment, while Mr. Wallace was treated to an extraordinary outbreak of official denunciation for merely asking permission to discuss a readjustment of his duties. These two cases should be considered carefully before Mr. Wallace is judged on the basis of published statements.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Santa Rosa, Cal.—Press reports state that the $200,000 bonds recently issued will be expended during this summer in completing the sewerage system, extending the water system and purchasing a pump with a capacity of 2,500,000 gal. daily and improving the streets and bridges; L. E. Ricksecker, City Engr.

Red Bluff, Cal.—F. W. Decker, Town Clk., writes that only preliminary steps have been taken as yet for the construction of water-works.

**Whittier, Cal.*—E. C. Butterfield, City Clk., writes that contract for machinery, etc., for the improved water works for Whittier have been awarded as follows: To the Pacific Drilling Co., of Los Angeles, for a well, $2 per ft. for any depth to 600 ft.; to the Crane Co., of Chicago, Ill., and Los Angeles, for 43,000 ft. of 4-in. and 2,700 ft. of 6-in. Converse lock joint pipe, and to the Pacific Coast Mfg. Co., of San Francisco, for furnishing and installing complete boilers, pump, engine and compressor for $42,910. The other bidders for the machinery complete were the Baker Iron Works, $40,169; United Iron Wks., $36,900, and the Machinery & Electric Co. (2 bids), $39,970 and $37,942.

Boulder, Colo.—Eugene Wilder, City Clk., writes that the proposed water works improvements will cost about $75,000. Bids will probably be called for in September. Jas. P. Maxwell, City Engr.

Wilmington, Del.—The Philadelphia, Baltimore & Washington R. R. Co. (W. N. Bannard, Div. Supt., Wilmington), is reported to have decided to construct a reservoir near Todd's Cut, for supplying water to its shops there.

**Washington, D. C.*—The contract for furnishing all material, except Portland cement, and constructing concrete steel sand bins for Washington Aqueduct (D. C.) filtration plant (bids opened June 29, by Lieut. Col. Smith S. Leach, Corps Engrs., U. S. A.) has been awarded to Rudolph S. Blome Co., of Chicago, Ill., for $48,838.

Atlanta, Ga.—The Finance Com. of Council has adopted a report recommending an issue of $500,000 bonds for water-works improvements and $500,000 for the erection of a new city hall.

Cochran, Ga.—See "Power Plants, Gas and Electricity."

Ft. Gaines, Ga.—See "Power Plants, Gas and Electricity."

Long Tree, Ia.—It is stated that bids will be received until Aug. 14 by R. L. Harris, City Clk., for constructing a system of water-works.

Sparta, Ill.—See "Electric Railways."

Bloomington, Ill.—Bids will be received by the Bd. of Local Improv. (J. S. Neville, Pres.) until Aug. 4 for the construction of a reservoir.

Chicago, Ill.—Bids will be received until August 9 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.), for expert services in the checking of drawings, the inspection of materials and workmanship, and the concluding of the official test of two 80 hp. boilers and a 3,000,000 gal. horizontal cross compound pumping engine, with appurtenances, for the Washington Heights pumping station.

Bids will be received until Aug. 2 for furnishing expert services in the inspection of materials and workmanship and for conducting the official test on 6 water-tube boilers, with appurtenances, being constructed for the 39th St. pumping station.

Thebes, Ill.—An election will soon be held to vote on issuing $20,000 bonds for water works. Richard H. Phillips, Consulting Eng., St. Louis, Mo.

Waukegan, Ill.—The City Engineer is reported to have completed plans for a crib for the water works, to cost $5,000.

Columbus, Ind.—It is reported that plans are being prepared for a filtration plant; Geo. Vorwald, City Clk.

**Evansville, Ind.*—The Trus. of the Southern Hospital for Insane at Woodmere are stated to have awarded the contract for the erection of the water supply system to the Chicago Bridge & Iron Wks., of Chicago, Ill., and the contract for the water softening system to the Kennicott Water Softening Co., of Chicago, Ill. The cost of both systems will be $10,500.

Muncie, Ind.—The City of Muncie will receive proposals, as advertised in the Engineering Record, for the construction of a complete system of water works, and offers a liberal franchise, including contract for water for quenching fires, and for all public uses; or the city will grant franchise and contract with parties who will purchase and operate water plant now being operated in said city.

Somerset, Ky.—See "Power Plants, Gas and Electricity."

Donaldsonville, La.—See "Schools."

Marksville, La.—See "Power Plants, Gas and Electricity."

Attleboro, Mass.—The Water Comrs. of Attleboro will dispose of the standpipe now in use and will receive propositions from purchasers until Oct. 12, as advertised in The Engineering Record.

Falmouth, Mass.—Bids will be received until Aug. 7 for about 387 tons 8 and 6-in. c. i. water pipe, 17 fire hydrants and 28 water gates and boxes, as advertised in The Engineering Record.

**Peabody, Mass.*—C. E. Trumbull Co., Tremont Bldg., Boston, has secured the contract for laying pipe for the additional water supply from Suntaug Lake, in Lynnfield, to Spring Pond, Peabody, for $23,680. The other bidders were W. B. Bryne, Medford, $31,141; Geo. M. Bryne Co., Boston, $27,050; Seymore, Clark, Hills Co., $26,354; M. McDonough, Swampscott, Mass., $26,163, and D. A. Dorey & Co., Everett, Mass., $36,226.

Augusta, Me.—Bids will be received by the Trustees of Augusta Water Dist. until Aug. 3 for building Carleton Pond dam and reservoir, as advertised in The Engineering Record.

Franklin, N. H.—Bids will be received until Aug. 9 by the Water Bd. (F. N. Parsons, Secy.) for building a covered concrete reservoir of about 250,000 gal. capacity and for laying about 4,000 ft. of 8 and 12-in. water pipe. F. L. Fuller, Engr., 12 Pearl St., Boston, Mass.

Grosse Pointe Farms, Mich.—J. G. Armstrong, Village Clk., writes that the citizens voted July 24 to issue $27,600 bonds to purchase the plant of the Grosse Point Water Wks. Co.

Republic, Mich.—Bids will be received by the Township Bd. until August 8 for constructing water works, consisting of a brick building, two 750,000 gal. pumps, 2 return tubular boilers, stack 8,000 ft. 8-in., 3762 ft. 6-in. and 2350 ft. 4-in. pipe; 27 double discharge fire hydrants, ten 8-in., ten 6-in. and six 4-in. valves, valve boxes, special castings, etc. Engineer Standard Eng. Co., 1032 Garfield Bldg., Cleveland, O.; Peter W. Pascil, Township Clk.

Grand Rapids, Minn.—It is reported that bids are wanted until Aug. 14 for laying 1,504 ft. 6-in. water mains; C. C. McAllister, Recorder.

Gloster, Miss.—The citizens are reported to have voted to issue $5,000 bonds to extend the water mains and $10,000 for the erection of a town hall.

Lincoln, Neb.—The Council is reported to be considering the question of improving the water-works at a cost of $46,000.

**Peterboro, N. H.*—Bruno & Milano, 293 North St., Boston, Mass., have secured the contract for laying water pipes and setting gates and hydrants for the proposed extension of water works in Peterboro (bids opened July 17) for $4,567. Engineer, Frank A. Gay, of Manchester.

Stromsburg, Neb.—The citizens are reported to have voted to issue $9,000 bonds for the extension of the water works.

Asbury Park, N. J.—The township of Ocean is reported to have granted the West Allenhurst Water Co. a franchise to install water-works and lay pipe in West Allenhurst. This company has a capital of $35,000. Stockholders: Wallace H. Blanchard, Archibald S. Reid and others. They will shortly meet at Asbury Park, and bids will be asked for construction.

Cranbury, N. J.—The Cranbury Water Co. has been incorporated, with a capital of $15,000, by Jas H. Conover, Geo. B. Mershon, Henry C. Symmes and others to construct and operate water-works in Cranbury.

Perth Amboy, N. J.—The Bd. of Water Comrs. is stated to have decided to adopt the plans of S. J. Mason, engineer of the board, for 16 ground storage wells. Four of the wells will be driven at once.

New York, N. Y.—The detail bid of Gallo & Pettelli, 127 Mulberry St., the lowest bidder, for furnishing material and changing line of 36-in. water main under N. Y. Central R. R. at Southern Boule., near 142d St., bids for which were opened on July 19 by John T. Oakley, Com. of Water Supply, Gas and Electricity, is as follows: 100 tons straight pipe, $30; 70 tons specials, $65; 275 cu. yds. rock, without blasting, $5; 20 cu. yds. masonry excav., $3; 650 cu. yds. earth excav., 50 cts.; 775 cu. yds. fill, 10 cts.; to lay 550 lin. ft. 36-in. pipe, $1.50; 230 lin. ft. 20-in., $1, and 200 lin. ft. 12-in., 30 cts.; 170 cu. yds. concrete masonry, $8, and 3,000 lbs. wrought-iron bolts, straps, etc., 5 cts.; total, $12,022. The total of other bidders, all of New York, were: Louis D. Gregory, $16,634; John Cornwell, $14,327; F. V. Smith Constr. Co., $16,790, and P. Goodman, $16,812.

Brooklyn, N. Y.—The following are the totals of bids, including hydrants and stopcocks, also unit prices on some of the items required for furnishing and laying mains in Metropolitan, Morgan and other streets in Brooklyn Boro. (bidders all of Brooklyn): (*a*) Donlon Contr. Co., 84 Bway., $40,020; (*b*) Borough Constr. Co., 44 Court St., $50,834; (*c*) I. Harris, 485 Flatbush Ave., $40,023, and (*d*) M. J. Dady, 350 Fulton St., $49,315.

	a	*b*	*c*	*d*
750 tons straight pipe	$28.00	$32.28	$27.50	$29.00
55 tons specials	57.00	63.60	60.00	65.00
20 tons special stopcock castings	25.00	63.60	60.00	65.00
7,600 lin. ft. 20-in. pipe	.90	1.51	.80	1.15
1,200 lin. ft. 16-in. pipe	.70	1.50	.60	1.00
1,200 lin. ft. 8-in. pipe	.40	.35	.60	1.00
500 lin. ft. 6-in. pipe	.25	.25	.60	1.00
200 cu. yd. extra excav.	1.50	1.50	1.00	60.00
1,300 sq. yd. block pav't, sand foundation	.30	.35	.40	.40
950 sq. yd. block pav't, con. foundation	1.50	1.75	2.00	3.00
180 sq. yd. asphalt pav't	2.75	4.00	3.50	3.00

Brooklyn, N. Y.—Bids were opened on July 19 by John T. Oakley, Comr. Water Supply, Gas and Electricity, N. Y. City, for remodeling and extending the Massapequa pumping station, including pumping plant, pump, well and infiltration gallery system, Boro. of Brooklyn. The following are the totals of bids received, including valves, also with prices on some of the items required: Borough Constr. Co., 44 Court St., $408,690, and M. J. Dady, 350 Fulton St., $391,850:

	a	*b*
1 engine and boiler house	$9,600.00	$10,000.00
1 coal shed, including trestle, &c.	6,000.00	7,500.00
3 steam pumping engines	17,500.00	20,000.00
3 boilers	6,000.00	12,000.00
Steam fitting equipment, feed pumps	1,700.00	5,000.00
75 lin ft. 36-in. flanged suction pipe	14.00	30.00
750 lin. ft. 48-in. hub and spigot d. pipe	18.40	30.00
1 pump well	5,970.00	10,000.00
Vitr. pipe in infiltrating galleries—		
8,100 lin. ft. 36-in.	14.60	10.00
1,600 lin. ft. 33-in.	14.00	10.00
4,300 lin. ft. 33-in.	23.63	18.00
1,600 lin. ft. 30-in.	12.58	10.00
550 lin. ft. 27-in.	12.24	10.00
1,100 lin. ft. 24-in.	10.56	10.00
1,100 lin. ft. 20-in.	9.85	10.00
52 single boxes and manholes	100.00	150.00
17 double boxes and manholes	150.00	200.00
1 wagon road, including concrete and steel highway bridge	750.00	5,000.00
20 cu. yds. brick masonry	15.00	20.00
16 M. ft. hemlock timber	25.00	40.00
1,000 cu. yds. extra gravel	1.50	.50
100 cu. yds. extra concrete	10.00	10.00
1000 cu. yds. earth excav.	2.00	2.00

Brooklyn, N. Y.—The following are the bids opened July 19 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing material and constructing the New Lots pumping station in Brooklyn Boro.: (Bidders of Brooklyn, unless otherwise mentioned): Jas. MacArthur, 22 Ormond Pl., $22,268; Fuller & O'Connor, $22,609; Chas. Meads Co., New York, $24,720; Thos. G. Carlier, $24,330, and Behan & Cavanagh, $23,737.

Bids were opened same time and place for furnishing and erecting 3 boilers at New Lots Pumping Sta.; (bidders all of N. Y. City): Edw. Burhorn, 71 Wall St., $20,330; B. Franklin Hart, Jr., Co., 114 Liberty St., $14,295, and A. D. Granger Co., 95 Liberty St., $20,800.

***Items marked thus give the names of parties awarded contracts.**

Brooklyn, N. Y.—Bids will be received until August 9 by John T. Oakley, Comr. of Water Supply, Gas and Electricity, N. Y. City, for furnishing material and erecting a new Gravesend pumping station on Ave. B and E. 6th St.; for plumbing and gas fitting for the high pressure fire service stations at Furman and Joralemon Sts. and Willoughby and St. Edwards Sts.; furnishing and delivering c. i. stop cock boxes and manhole heads; overhauling and repairing the Davidson engines at the Millburn pumping station, near Baldwins; furnishing engineers' and draughtsmen's, contractors' and machinists' supplies; bar iron, machinery steel, tool steel and tobin bronze. All in the Boro. of Brooklyn.

Utica, N. Y.—Local press reports state that the contractor recently awarded the contract by the Consolidated Water Co. of Utica for constructing 4½ miles of new pipe line, at a cost of $90,000, has forfeited his contract, and it is said that the company will do the work with a force of its own men.

**Buffalo, N. Y.*—The Bd. of Aldermen on July 24 awarded contracts for rebuilding the pumping station as a fireproof structure as follows: Masonry, E. I. Crooker, $118,940; roofing, Machwirth Bros., $25,553; iron and steel work, Kellogg Iron Wks., $39,840; painting, Max Kurchoff, Jr., $2,600, and plumbing, C. A. Criqui, $7,697. The contract for repairing the intake pier was awarded to the Buffalo Dredging Co. for $34,940.

At a meeting of the Bd. of Aldermen July 24 Francis G. Ward, Comr. of Pub. Wks., submitted plans and specifications for the proposed pumping station and intake tunnel. Two plans were submitted, one to cost $843,634 and the other $840,200. The plans call for a pumping station and a tunnel connecting the present and proposed pumping stations. He suggested that the plans be submitted to Col. Thos. W. Symons, Gen. Geo. S. Field and Rudolph Hering, of New York. The Aldermen agreed, and those 3 men will act as an expert commission, provided the Councilmen and the Mayor approve.

Lake Placid, N. Y.—See "Power Plants, Gas and Electricity."

**Rochester, N. Y.*—The following are reported to be the bids opened on July 19 for the construction of Cobbs Hill reservoir: Denniston & Co., Rochester, $390,805 (awarded contract); Casey & Murray, Rochester, $396,820; Henry P. Burgard, Buffalo, $399,185; Continental Engr. & Contr. Co., Buffalo, $452,455; Thos. Holahan, Rochester, $455,520; Continental Asphalt Paving Co., New York, $509,674; I. M. Ludington, Oxford, $552,150; Whitmore, Rauber & Vicinus, Rochester, $558,300; Wm. J. Flanagan, Katonah, $563,540, and Brodhead Contr. Co., Wilkesbarre, Pa., $572,270.

Troy, N. Y.—Bids will be received until Aug. 8 by the Bd. Contract and Supply (Jas. M. Riley, Clk.) for furnishing and building a 5-ft. diam. steel pipe about 310 ft. long into and through the present culvert under the Tomhannock Dam; the furnishing and placing of the necessary valves, sluice gates and other specials and the building of 2 small gate houses.

Arcanum, O.—See "Power Plants, Gas and Electricity."

Conneaut, O.—C. E. Chapin, of Canton, is preparing plans for the improvements contemplated by the Conneaut Water Co.

Corvallis, Ore.—The citizens are reported to have decided to issue $75,000 bonds for the construction of a gravity system of water works.

Cottage Grove, Ore.—J. E. Young, City Recorder, writes that bids will be received about Aug. 10 for the construction of water works, to cost about $15,000.

Dover, Pa.—The Town Council has selected Chas. S. York, 1526 E. Biddle St., Baltimore, Md., to prepare plans for a complete system of water-works. Specifications and plans will be ready about the middle of August. Water will be obtained from deep wells.

Oxford, Pa.—Local press reports state that all bids opened July 17 by the Boro. Council for water works, have been rejected, and the plans will be revised and new bids received.

Panama.—Bids will be received until Aug. 25 by the Isthmian Canal Comn. (D. W. Ross, Gen. Purchasing Agt.), Washington D. C., for furnishing at Panama iron pipe, and pipe fittings, lead pipe, valves, etc., as advertised in The Engineering Record.

Pittsburg, Pa.—The question of extending the water pipe system in the 19th, 20th, 21st, 14th and 24th Wards, is reported under consideration; the probable cost of the work proposed is said to be $1,000,000.

Pawtucket, R. I.—The City Council on July 21 passed a resolution providing for an appropriation of $31,000 for the purchase of property for water works purposes. The question of expending about $225,000 for additional pumping facilities is reported under consideration.

**Bishopville, S. C.*—Contracts for constructing water-works (bids opened July 17) have been awarded as follows: For 75,000-gal. tank and tower, steam plant, 15,800 ft. 10, 8 and 6-in. c. i. pipe, setting valves, etc., to Thornwell McMaster, Columbia, $19,649; for two 40-h.p. tubular boilers, to Cole Mfg. Co., of Newman, Ga.; 2 d.-a. duplex steam pumps, to the International St. Pump Co., Atlanta, Ga.; for 6, 8 and 10-in. c. i. pipe to the Glamorgan Pipe & Fdy. Co., Lynchburg, Va., at $28, $27.50 and $27 per ton, respectively, and for gates, hydrants and castings, to the Fairbank Co., Troy, N. Y. Engineer, Chas. C. Wilson, Columbia.

New York, N. Y.—Bids were opened on July 19 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water wains in Allen, Bayard, Broome and other streets in Manhattan Boro. The following are the totals of bids received, including stopcocks, hydrants, blow-offs, etc.; also note prices on some of the items required: (*a*) Louis D. Gregory, $327.232; (*b*) John Cornwell, Jr., 69 E. 127th St., $336,703; (*c*) Cunningham & Kearns, 438 E. 91st St., $316,023; (*d*) Burns & Rodgers, 1909 Amsterdam Ave., $311,216; (*e*) Norton & Dalton, 27 W. 140th St., $362,630, and (*f*) P. Goodman, 1668 Park Ave., $300,436.

	a	*b*	*c*	*d*	*e*	*f*
3,330 tons of straight pipe	$31.00	$30.00	$28.00	$29.00	$28.50	$27.80
160 tons branches and special castings	70.00	60.00	62.00	60.00	60.00	60.00
100 cu. yd. rock excav., without blasting	.01	10.00	5.00	5.00	10.00	.01
1,800 cu. yd. rock excav	.01	.40	.40	.42	.50	.01
300 cu. yd. of masonry excav	2.00	.40	.40	.42	4.00	6.00
50,500 cu. yd. fill	.40	.40	.39	.42	.50	.30
50,500 cu. yd. earth excav	.40	.40	.39	.42	.50	.30
Laying pipe.						
5,900 lin. ft. 20-in	.80	.75	.58	.60	.90	1.00
58,000 lin. ft. 12-in	.40	.45	.35	.40	.60	.40
12,300 lin. ft. 6-in	.20	.30	.20	.20	.40	.20
Connections to be made without shutting off water.						
3 36x20-in	350.00	300.00	500.00	400.00	400.00	325.00
5 36x12-in	200.00	200.00	200.00	250.00	300.00	160.00
1 24x20-in	300.00	175.00	300.00	400.00	250.00	270.00
4 24x12-in	150.00	160.00	150.00	250.00	250.00	125.00
18 20x12-in	125.00	160.00	100.00	225.00	150.00	105.00
100 cu. yd. brick masonry	15.00	18.00	10.00	12.00	15.00	20.00
30 cu. yd. of concrete masonry	6.00	6.00	5.00	10.00	10.00	10.00
17,100 sq. yd. sheet or block asphalt pav't and stone sidewalks, to relay.	4.10	4.50	4.00	3.50	5.00	4.00
3,800 sq. yd. granite block pav't on concrete foundation and tar and gravel or cement joints, to relay	1.50	1.50	2.00	2.00	2.00	2.00
6,200 sq. yd. pav't and flagging, to relay	.50	.50	.30	.50	.60	.75

Brooklyn, N. Y.—The following are the bids opened on July 19 by John T. Oakley, Comr. Water Supply, Gas and Electricity, New York City, for furnishing and installing 5 electrically-driven pumps for high-pressure fire service in pumping station, to be erected on Furman and Joralemon Sts., Brooklyn: (Bidders of N. Y. City unless otherwise mentioned): (*a*) Johnston Livingston, Jr., Co., 113 E. 22d St.; (*b*) Platt Iron Works, 93 Liberty St.; (*c*) Camden Iron Wks., Camden, N. J.; (*d*) Henry Worthington, 114 Liberty St.; (*e*) D'Olier Engr. Co., 74 Cortlandt St.; (*f*) Allis-Chalmers Co., 71 Bway:

	a	*b*	*c*	*d*	*e*	*f*
1,200 cu yds. earth excav	$2.00	$2.90	$3.00	$3.00	$1.65	$1.82
400 cu. yds. concrete	10.00	7.60	7.00	7.50	7.80	10.25
1,500 lin. ft. piling	.34	.30	.30	.50	.25	.27½
200,000 lbs. castings for trench covers, &c	.039	.0475	.035	.045	.0125	.04
5 pumps, with all appliances, valves, meters, etc.	113,493.00	120,256.00	98,537.00	103,337.00	103,086.00	127,234.00
Total	$128.203	$136,726	$112,387	$119,687	$110,701	$141,930

Brooklyn, N. Y.—The following are the bids opened on July 19 by John T. Oakley, Comr. of Water Supply, Gas and Electricity, for furnishing and installing 3 electrically-driven pumps ,with all appliances complete, for high-pressure fire service, in a pumping station to be erected on Willoughby and St. Edwards Sts., Brooklyn Boro.: (bidders of N. Y. City unless otherwise mentioned: (*a*) Johns E. 22d St.; (*b*) D'Olier Engr.on Livingston, Jr., Co., 113 Co., 74 Cortlandt St.; (*c*) Henry R. Worthington, 114 Liberty St.; (*d*) Platt Iron Works, 93 Liberty St.; (*e*) Camden Iron Wks., Camden, N. J.; (*f*) Allis-Chalmers Co., 71 Bway:

	a	*b*	*c*	*d*	*e*	*f*
750 cu. yds. earth excav	$2.00	$1.65	$3.00	$2.80	$2.00	$1.82
300 cu. yds. concrete	10.00	7.50	7.50	7.50	6.00	10.25
1,000 lin. ft. piling	.34	.05	.50	.30	.30	.27½
150,000 lb. iron castings for trench, covers, etc.	.039	.0125	.045	.0475	.035	.04
3 pumps with appliances, valves, meters, etc.	63,722.00	58,910.00	56,577.00	68,810.00	58,445.00	73,768.00
Total	$74,412	$64,322	$68,327	$80,585	$67,295	$84,483

**Havre, Mont.*—Bids were opened on July 18 for the installation of a system of water mains and the construction of a reservoir and appurtenances. The following are the totals of bids received, including hydrants, valves, etc.; also unit prices on some of the items required: (*a*) Lease & Richards, Havre, Mont. $44,488; Jas. H. Donlin, Great Falls, $45,982, and (*c*) Fuller & Bossart, Havre, $42,413 (awarded contract):

	a	*b*	**c*
Distribution System.			
10,000 cu. yds earth, excav. and fill	$0.60	$0.65	$0.48
2,622 ft. 4-in. c. i. pipe	.67¼	.68	.70
13,620 ft. 6-in. c. i. pipe	1.07½	1.06	1.08
5,225 ft. 8-in. c. i. pipe	1.54	1.69	1.52
358 ft. 10-in. c. i. pipe	2.15	2.06	2.20
1,985 ft. 10-in. wooden stave pipe	.71⅓	.62	.70
18,360 lbs. special castings	.07 1/6	.06	.05
2 M. ft. lumber for sheathing	31.00	25.00	20.00
Reservoir.			
1,900 cu. yds. earth, excav. and embankment	.60	.60	.52
310 cu. yds. concrete	11.20	14.50	11.00
75 cu. yds. broken stone	3.10	4.00	4.00
12 M. ft. lumber, in place	31.00	25.00	26.00
1 gate house	100.00	125.00	52.00
All pipe, valves, special, complete (lump sum)	806.00	905.91	635.72

Ft. Moultrie, S. C.—Bids will be received until Aug. 26 by F. W. Cole, Q. M., U. S. A., for constructing a reservoir and installing boiler and pump in present pump-house here.

Austin, Tex.—The Municipal Water and Light Comn. is reported to have decided to erect a new standpipe.

Llano, Tex.—See "Power Plants, Gas and Electricity."

Bolivar, Tenn.—See "Power Plants, Gas and Electricity."

Ft. Ringgold, Tex.—Bids will be received until Aug. 26 by Robt. R. Stevens, Ch. Q. M., U. S. A., San Antonio, for furnishing and installing a 40-hp. steam boiler at pumping station at Ft. Ringgold.

Jackson, Mo.—See "Power Plants, Gas and Electricity."

Monroe, Utah.—Wm. A. Warnock, City Clk., writes that Engineer Kelsey, of Salt Lake City, is preparing estimates for the construction of water works.

Provo, Utah.—See "Power Plants, Gas and Electricity."

Seattle, Wash.—Bids will be received until Aug. 5 by C. B. Bagley, Secy. Bd. Pub. Wks., for laying water mains on Nob. Hill Ave. and other streets to cost about $5,900; also in Lane and other streets, to cost about $26,200.

Casper, Wyo.—A. P. Davis, of Washington, D. C., Acting Ch. Engr. Dept. of Interior, U. S. Geological Survey, writes that all bids opened June 15 for the construction of the Pathfinder dam and auxiliary works, to impound flow of North Platte River, have been rejected. New bids will be received at the office of the Superv. Eng. U. S. Reclamation Service, Denver, Colo., on August 16, as advertised in the Engineering Record. For list of bids received for this work, see issue of the Engineering Record June 24.

Ft. Williams, Ont.—A. M. McNaughton, City Clk., writes that it is proposed to secure a new water supply by gravitation from Loch Lomond, at a cost of $220,000. Engineer, John Galt, of Toronto.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Santa Rosa, Cal.—See "Water."

Alameda, Cal.—The City Trus. are reported to have authorized W. R. Poyzer, City Engr., to prepare plans for sewers in Eagle Ave. and Bway. and in San Jose Ave.

New Britain, Conn.—The only bid received and opened on July 17 for constructing Section B of the new sewerage system was submitted by the Bunting Constr. Co., Long Island City, N. Y., for $56,367. This bid was rejected and new bids will be received for this section on Aug. 15, as advertised in The Engineering Record.

*Bids on the other three sections opened on July 17 were as follows, (1) Section A, (2) Section C, (3) Section D: J. H. Clements, 502 Hamilton St., Schenectady, N. Y., (1) $8,531 (awarded contract), (3) $9,919 (awarded contract); Bunting Constr. Co., Long Island City, N. Y., (1) $23,358, (2) $55,858, (3) $31,334; Edw. Tracy, 200 Olivia St., Derby, Conn., (1) $12,957; Falvey & Kelly 13 Center Ave., Dorchester, Mass., (1) $10,326, (2) $30,031 (awarded contract), (3) $12,967.

*The detail bids on Section C were as follows, (*a*) Bunting Constr. Co., $55,858; (*b*) Falvey & Kelly, $30,031 (awarded contract):

	a	**b*
Excav. and laying pipe.		
1,679 lin. ft. 18-in. pipe	$3.50	$2.50
4,604 lin. ft. 15-in. pipe	2,50	2.00
1,796 lin. ft. 12-in. pipe	2.50	1.25
1,033 lin. ft. 10-in. pipe	2.00	.70
2,025 lin. ft. 6-in. pipe	1.30	.70
65 manholes (concrete)	60.00	30.00
200 cu. yd. rock excav	4.50	6.00
Excav. and laying pipe.		
750 lin. ft. 20-in. S.W. pipe	2.30	.75
2,830 lin. ft. 15-in. S.W. pipe	1.60	.55
13,732 lin. ft. 12-in. S.W. pipe	1.30	.50

Washington, D. C.—The following are the bids opened on July 24 by the Comrs. D. C. for constructing a portion of sewage disposal system, 4½ St. high-level intercepting sewer (Dan'l E. McComb, Supt. of Sewers), (*a*) Sullivan Bros., $59,337; (*b*) J. H. Louchheim, $60,784, and (*c*) The J. Connelly Constr. Co., $62,490.

	a	*b*	*c*
20,275 cu. yd. excav	$1.46	$1.51	$1.50
225 cu. yd. brick mas'ry	12.00	13.25	14.00
325 cu. yd. vitr. brick mas'ry	21.00	19.50	21.50
1,470 cu. yd. concrete B	7.40	7.50	7.75
1,230 cu. yd. concrete C	6.90	7.30	7.75
3,384 lin. ft. 6-in. underdrain	.28	.25	.30

Washington, D. C.—G. McDonald is reported to have secured the contract for constructing the sewer crossing 14th St. for $5,116.

Chicago, Ill.—Bids will be received until Aug. 2 by the Bd. Local Improv. (Andrew M. Lynch, Pres.) for constructing vitrified tile sewers in portions of several streets and for constructing a system of brick and vitrified tile sewers in several other streets.

**Rock Falls, Ill.*—Walter Murray, Mayor, writes that the contract for constructing between 3 and 4 miles of pipe sewers, from 8 to 24 in., has been awarded to W. N. Dearborne, of Stone City, Ia., for $15,401.

Chicago, Ill.—Bids will be received by the Bd. of Local Improv., Aug. 23, for the construction of a system of concrete sewers, about 15 miles in length, and ranging from 10½ ft. to 3 ft. diam.; also for the construction of a pumping station and the erection of 3 centrifugal pumping engines, as advertised in The Engineering Record.

Pana, Ill.—The Council is reported to have appropriated $12,000 for new sewers.

**Greensburg, Ind.*—Pulse & Porter are reported to have secured the contract for constructing sewers at Greensburg for $93,226.

Tell City, Ind.—Frank Hinkel, City Clk., writes that bids will be received until Aug. 8 for the construction of a main pipe sewer in Washington St.

Mooresville, Ind.—An ordinance has been passed in Council, granting the Indianapolis Sanitary Co. a franchise for a sewerage system. J. E. Comer, Town Clk.

Winchester, Ind.—It is stated that bids will be received until Aug. 16 for constructing 6,400 ft. of sewer. C. C. Yunker, City Engr.

Indianapolis, Ind.—Bids will be received until Aug. 9 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for constructing a 10 to 12-in. pipe sewer in portions of the alleys east and west of Euclid Ave.

**Items marked thus give the names of parties awarded contracts.*

*_West Lafayette, Ind._—C. V. Seastone, Town Engr., writes that the following are the bids opened on July 17 for the construction of sewers. The prices include excavation, all of which is in coarse gravel (*_a_) W. H. Harris, Terre Haute (awarded contract); (_b_) Hines & Bowlin, Frankfort; (_c_) Chas. Terry, West Lafayette (prices on pipe include Y's):

	*_a_	_b_	_c_
Concrete sewer—			
1,100 ft. 36-in., cut 6 to 10 ft.	$3.90	$3.50	$6.35
Pipe Sewers—			
300 ft. 30-in.	2.85	2.70	3.45
3,440 ft. 22-in., av. cut = 11 ft. max. cut = 17 ft.	1.42	2.00	5.61
200 ft. 14-in., av. cut = 7.5 ft.	1.03	1.22	1.20
750 ft. 12-in., av. cut = 8.7 ft.	.84	1.02	1.12
3,500 ft. 10-in., av. cut = 8 ft.	.72	.87	.95
5,800 ft. 8 in., av. cut = 7.5 ft.	.60	.83	.80
3,500 ft. 6-in., av. cut = 6 ft.	.49	.75	.70
4 6-in. Y's on 30-in. pipe, each	6.00	6.00	...
27 6-in. Y's on 22-in. pipe, each	1.75	1.75	...
24 6-in. Y's on 12-in. pipe, each	1.00	1.00	...
70 6-in. Y's on 10-in. pipe, each	.85	.75	...
140 6-in. Y's on 8-in. pipe, each	.75	.60	...
76 6-in. Y's on 6-in. pipe, each	.60	.50	...
16 manholes (ordinary)	39.00	40.00	32.00
10 catchbasins (brick)	33.00	35.00	35.00
6 flushtanks (300 gal.)	75.00	80.00	75.00
9 lamp holes	9.00	10.00	6.00
6½ cu. yds. concrete, outfall abut	7.50	8.50	6.25
Total	$20,750	$24,800	$40,800

Clinton, Ia.—Bids will be received on August 24 for about 4 miles of brick and concrete sewers. Engineer, Chas. P. Chase, of the Iowa Eng. Co., of Clinton.

Perry, Ia.—All bids opened July 18 for constructing a sewerage system have been rejected and new bids will be received Aug. 2. Adrian Cross, City Clk. Engineer, M. A. Earl, 1416 1st Natl. Bank Bldg., Chicago, Ill.

Baton Rouge, La.—Contracts will probably soon be let for 3 miles of street paving and 5 miles of sewers.

Quincy, Mass.—The City Council on July 21 appropriated $25,000 for the extension of the sewerage system. Hamilton Flood, City Engr.

Saginaw, Mich.—The Bd. of Estimate is reported to have appropriated $15,000 for new sewers.

Crystal Falls, Mich.—The Council is reported to have decided to establish a sewer district, also employ an engineer to prepare plans for the proposed sewerage system.

New Ulm, Minn.—The citizens are reported to have voted, July 18, to issue $30,000 bonds for sewers.

St. Paul, Minn.—The Bd. of Pub. Wk.s is reported to have ordered a favorable report on a system of sewers in Fairview and other streets, to cost about $26,000.

Bemidji, Minn.—The question of constructing a sewerage system is reported under consideration by City Council.

Gulfport, Miss.—It is stated that bids will be received until Aug. 2 for constructing sewers. Wm. F. Wilcox, Engr.

Kansas City, Mo.—The Bd. of Park Comrs. is reported to have agreed to pay a part of the expense of building a storm sewer along Gillham Road, from 38th St. to Brush Creek. The sewer will cost about $100,000.

Kirksville, Mo.—The question of constructing a sewerage system to cost $30,000 is reported under consideration.

Anaconda, Mont.—Bids will be received until Aug. 7 for constructing 7,000 ft. of 15-in. pipe sewers, estimated to cost $10,000; P. Sullivan, City Clk.

Phillipsburg, N. J.—Bids will be received until Aug. 5 by John Shafer, Chmn. Sewer Com., 4 John St., for constructing a sewer in said town requiring 4,822 ft. of 8 to 18-in. vitrified pipe, 23 manholes and 15 catch basins, as advertised in The Engineering Record.

*_Summit, N. J._— Edw. D. Rich, City Eng., writes that the Harrison Constr. Co., of Newark, has secured the contract for constructing the North Side storm sewer (bids opened July 18) at the following detailed bid: 6,100 cu. yds. earth excav., under 8 ft. deep, 30 cts.; 850 cu. yds. earth excav., 8 to 14 ft. deep, 60 cts.; 20 cu. yds. rock excav., under 8 ft., $3; 10 cu. yds. rock excav., under 8 to 14 ft., $4; 14 cu. yds. concrete, $6; for laying sewer pipe, 1,020 lin. ft. 12-in., 45 cts.; 2,243 lin. ft. 15-in., 70 cts.; 1,362 lin. ft. 18-in., 85 cts.; 575 lin. ft. 20-in., $1.10; 530 lin. ft. 24-in., $1.50; 16 line manholes, each $42; 1 junction manhole, $45; 34 catchbasins, each $47; total cost, $9,483. The only other bid was that of Reynolds & Conway, for $15,046. For the South Side storm sewers, the Harrison Constr. Co. bid $5,884, and Reynolds & Conway $8,863.

Brooklyn, N. Y.—Bids will be received until August 2 by Martin W. Littleton, President Brooklyn Borough, for furnishing material and constructing sewers in portions of several streets. Engineer's estimate: 820 lin. ft. 36-in. and 270 lin. ft. 30-in. reinforced concrete sewer, 3430 lin. ft. 12-in., 415 lin. ft. 15-in., 279 ft. 18-in., and 558 lin. ft. 24-in. pipe sewer, etc.

Mohawk, N. Y.—The State Bd. of Health is reported to have approved plans for a sewerage system for the village. It has not yet been decided to place sewers in the village, but there is some talk of doing so.

Dunkirk, N. Y.—Jas. Morrissey, City Engineer, writes that it is proposed to construct sewers in the 1st and 4th wards, to be mostly, if not all, of tile.

Utica, N. Y.—The following are reported to be the bids opened on July 21 for the construction of the proposed intercepting sewer, (_a_) brick and stone, (_b_) concrete: Eldridge & Roberts, _a_ $277,132, _b_ $268,732; Chas. I. Williams, _a_ $210,979, _b_ $198,847; Besch & Bebee, _a_ $188,696, _b_ $170,528; Albany Material & Constr. Co., _a_ $192,102, _b_ $188,502; Harrison Constr. Co., _a_ or _b_ $207,664; J. J. Dwyer & Son, _a_ $192,786, _b_ $181,387; David Peoples, _a_ $247,484, _b_ $231,152; Casey & Murray, _a_ $191,397, _b_ $178,797.

Wilmington, N. C.—The Bd. of Aldermen is reported to have granted the Brooklyn Sewerage Co. a franchise to construct a system of sanitary sewerage in the section of the city north of 4th St. Bridge. All surveys are to be made by P. Matthew, City Engr.

Warren, O.—It is stated that bids will be received until Aug. 1 by the Sewer Com. (E. T. Beck, Chmn.) for constructing sewers in the Boro. of Warren.

Bowling Green, O.—The city is reported to be considering the question of sewage disposal.

Columbus, O.—Bids will be received until August 4 by the Board Public Service (Chas. H. Frank, Secretary), for constructing the Renick run storm water sewer and a portion of the West Side sanitary sewer; also on same date for constructing the West Side sanitary sewer in Jackson Pike in Franklin Township and cross over sewers in Sullivan Ave. and McDowell St.

Steubenville, O.—Bids will be received by the Bd. of Pub. Service on Aug. 21 for the construction of 5,380 lin. ft. of 36-in. brick or pipe sewer, with 22 manholes and 38 catchbasins, as advertised in The Engineering Record.

Ravenna, O.—The City Council is stated to have passed an ordinance providing for the issue of $65,000 additional sewerage bonds, making a total of $105,000 for the proposed system.

Norwood, O.—Bids will be received until Aug. 19 by the Bd. Pub. Service (E. R. Edwards Clk.), for furnishing materials and constructing sewers in portions of Lowry St., Sherman and Crossley Aves.

Gallitzin, Pa.—Bids will be received until Aug. 1 for constructing terra cotta sewers. Henry & Dillman, Engrs., Rm. 49 Altoona Trust Bldg., Altoona; W. R. Conrad, Boro. Secy.

Pittston, Pa.—Bids will be received until Aug. 3 for constructing lateral sewers in a portion of Vine and Fulton Sts., and a culvert across W. Railroad St.; J. T. Flannery, City Clk.

Johnstown, Pa.—The Council is reported to have adopted a resolution authorizing the City Engineer to prepare preliminary plans and specifications for a sewerage system.

*_Groton, S. D._—Jones & Roderick, of Canton, have secured the contract for 1,539 ft. 12-in. sewer at 74¾ cts. per lin. ft. and for manholes $39.90 each (bids opened July 17). W. A. Burnham, City Aud.

Alexandria, S. D.—Residents of the east side are reported to have organized the Alexandria Sewerage Co., for the purpose of constructing a sewerage system in that part of the town.

Wagoner, Ind. Ter.—H. H. Heller, City Engineer, writes that it is proposed to construct a storm and sanitary sewer, at a cost of $25,000.

Seattle, Wash.—The Green Lake Improvement Club is reported to have presented to Council a petition asking that a sewerage system be installed in the Green Lake District.

Beloit, Wis.—Robt. Caldwell, City Engr., writes that bids recently received for sewer work have been rejected and new bids will be received. Date not yet set.

*_Mauston, Wis._—The contract for constructing 3,518 ft. pipe sewers (bids opened July 21) has been awarded to Sweeney Bros., of Reedsburg, for $5,188, pipe to be furnished by the Union Sewer Pipe Co., of Red Wing, Minn. W. G. Kirchoffer, Consulting Engr., Madison.

BRIDGES.

Notes Arranged Alphabetically by States.

San Jose, Cal.—It is proposed to construct a concrete culvert over Permanente Creek on Wiremonte Ave., near Mountain View; J. G. McMillen, County Surv.

*_Fresno, Cal._—T. R. Harrold, Deputy County Surveyor, writes that the following are the bids opened July 17 for the construction of a reinforced concrete bridge over San Joaquin River at Pollaskey: Worswich Street Paving Co., Fresno, $54,900; Cotton Bros. & Co., Oakland, $49,983; W. N. Con Canon, San Francisco, $57,750; Burrell Constr. Co., San Francisco, $53,780, and Pacific Constr. Co., San Francisco $49,583 (awarded contract). This bridge will be constructed of reinforced concrete throughout and will have corrugated steel bars; length of bridge, 780 ft.; 10 spans, 65 ft. each, and 2 spans, 48 ft. each; approaches, 17 ft.; width of roadway in clear, 18 ft.; height of bridge, 20 ft. above low water.

Santa Rosa, Cal.—See "Water."

Stockton, Cal.—It is stated that bids will be received until Aug. 8 by Eugene D. Graham, Co. Clk., for constructing a concrete bridge across Powder House Slough, on the French Camp Turnpike.

Boulder, Colo.—Bids will be received Aug. 2 for constructing a steel bridge across Boulder Creek at 12th St. Eugene Wilder, City Clk.

Hartford, Conn.—F. L. Ford, City Engr., writes that the following are the bids opened July 19 for the superstructure and substructure, etc., of highway bridge over tracks of Central N. E. Ry., at Albany Ave.: Superstructure, (_a_) amount of bid, (_b_) time at $5 per day: Berlin Constr. Co., Berlin, _a_ $6,490, _b_ 30 days; Owego Bridge Co., Owego, N. Y., _a_ $6,584, _b_ 5 months; Boston Bridge Wks., Boston, Mass., _a_ $6,852, _b_ 4 months; Canton Bridge Co., Canton, O., _a_ $6,400 (no time stated, bid not allowed); King Bridge Co., Cleveland, O., _a_ $6,600, _b_ 6 months; Belmont Iron Wks., Philadelphia, Pa., _a_ $6,964, _b_ 120 days; Groton Bridge Co., Worcester, Mass., _a_ $6,875, _b_ 90 days; L. F. Shoemaker & Co., New Haven, _a_ $6,794, _b_ 75 days; Eastern Bridge & Structural Co., Worcester, Mass., _a_ $6,890, _b_ 14 weeks; American Bridge Co., New York, N. Y., _a_ $6,540, _b_ 4 months.

Substructure and foundations, (_a_) amount of bid, (_b_. time at $5 per day: F. T. Ley & Co., Springfield, Mass., _a_ $20,448, _b_ 50 days; C. W. Blakeslee & Sons, New Haven, _a_ $11,450, _b_ 90 days; F. B. & W. H. O'Neil, Hartford, _a_ $10,790, _b_ 87 days; Frank Pidgeon, Saugerties, N. Y., _a_ $16,469, _b_ 110 days; Michael Sheedy, Hartford, _a_ $16,921, _b_ 140 days; Geo. M. Atkins Co., Palmer, Mass., _a_ $10,950, _b_ 50 days.

Washington, D. C.—The Comrs. are stated to have decided to construct a concrete bridge probably 125 ft. long, with 25 ft. roadway, over Piney Branch, in the extension of 16th St., at probable cost of $50,000.

Jacksonville, Fla.—Bids will be received until Aug. 9 by the Co. Comrs. (F. J. Hyde, Chmn.) for constructing the foundation for 2 steel bridges across Little and Big Fishweir Creeks, on the new Orange Park Road. For further information apply to Roland Woodward, C. E., Room 6, Bd. Trade Bldg.

Rensselaer, Ind.—It is reported that bids are wanted until Aug. 7 for constructing 2 steel bridges in this Co.; Jas. H. Leatherman, Aud.

Brownstown, Ind.—It is reported that bids are wanted until Aug. 8 for constructing 13 bridges in this Co.; H. W. Walker, Aud.

*_Kendallville, Ind._—The National Bridge Co., of Indianapolis, is stated to have received the contract for constructing a bridge over Little Cedar Creek, west of Auburn Junction, for the Toledo & Chicago Interurban Co. The structure to be 2 spans, each 40 ft. long, of concrete and steel.

New Albany, Ind.—It is reported that bids will be received until Aug. 7 for 2 masonry stone abutments for a bridge to be constructed across Little Indian Creek, on the Vincennes Road in Lafayette Township, and also separate bids for the construction of a 60-ft. iron superstructure to be placed on said abutments; also for the abutments and superstructure of a 50-ft. iron bridge to be constructed in Georgetown Township. Thos. Hamlon, Co. Aud.

*_Topeka, Kan._—The Topeka Bridge & Iron Co., of Topeka, is stated to have secured the contract for constructing an 880-ft. bridge containing 6 spans at Sardow Ave., for $13,900.

Benton Harbor, Mich.—The Joint River Bridge Com. of Benton Harbor and St. Joseph is stated to have decided to recommend constructing a new bridge, to be the hoist pattern, to cost, with approaches, about $25,000.

Stockton, Mo.—It is reported that bids willl be received by the Co. Comrs. until Aug. 11 for constructing a steel bridge, 1800 ft. long, in Cedar County. J. H. Butler, Co. Clk.

Jefferson City, Mo.—The construction of a bridge at Lock and Dam No. 1, over Osage River, is reported under consideration.

*_Bloomington, Neb._—John Parker, Co. Clk., writes that the contract for constructing a 2-span steel bridge over Republic River has been awarded to H. T. Ward & Co., of Tecumseh, Neb.

Batesville, N. J.—Bids will be received until Aug. 7 by the Bridge Com. (Geo. W. Wythe, Chmn.) at Camden for constructing an iron bridge across Cooper's Creek at Batesville, near Haddonfield. Plans and specifications may be had by mail on the receipt of 50 cts. J. J. Albertson, Co. Engr.

Salem, N. J.—Bids will be received by C. C. Ford, Jr., Clk. Bd. Chosen Freeholders at Salem, on Aug. 9 for the construction of an iron highway bridge over Alloway's Creek, on road from Salem to Harmersville, as advertised in The Engineering Record.

New York, N. Y.—Bids will be received until Aug. 1 by Louis F. Haffen, Pres. Bronx Boro., for extension of bridges across Port Morris Branch R. R., at Elton Ave., 162d St. and Washington Ave., and all work incidental thereto.

*_Moravia, N. Y._—The Village Trus. are stated to have awarded the contract for constructing the Main St. Bridge to the Owego Bridge Co., of Owego, at a cost of $7,900.

Cleveland, O.—Bids will be received until Aug. 16 by the Co. Comrs. (Julius C. Dorn, Clk.), for constructing masonry arches in Warrensville and Newburgh Townships.

Ironton, O.—E. Fisher, Ch. Engr. Ashland & Ironton Bridge Co., of Ironton, writes that plans and specifications for the substructure of a double-track railway bridge across Ohio River at Ironton are now being made. There will be 6 concrete piers; 3 of the piers in the channel will be about 70 ft. high above low water; footings 10 to 15 ft. below water on rock, overlaid with 6 to 10 ft. of sand, gravel and boulders. The work is to be done during the next 5 months. He further states that he will be glad to communicate with contractors prepared to figure on this work.

Springfield, O.—Bids will be received by the Bd. of Public Service until Aug. 3 for the construction of the superstructure of a bridge across Buck Creek on Water St., as advertised in The Engineering Record.

St. Clairsville, O.—Bids will be received separately on the stone or concrete substructure and the steel superstructures of 5 bridges to be constructed as follows: A 1-span, 80-ft. bridge in Colerain Township; a 2-span bridge, each span 70 ft. long, in Pease Township; a 1-span, 62-ft. bridge in Wayne Township, and a 1-span, 30-ft. bridge in Kirkwood and York Townships. A. W. Beatty, Co. Aud.

Norristown, Pa.—Bids will be received until Aug. 19 by the Co. Comrs. (John H. Dager, Engr.), for constructing the masonry for a steel bridge to be constructed across Zacharias Creek, in Worcester Township.

*_Pittsburg, Pa._—The County Comrs. are stated to have awarded the contract for constructing superstructure of a bridge over Hartman's Run to the Pittsburg Bridge & Iron Wks. Co., for $14,905; Jerry L. Poli having received the contract for the masonry work at $10.19 per cu. yd.

Items marked thus give the names of parties awarded contracts.

Providence, R. I.—The following are the bids opened on July 12 by Walter F. Slade, Comr. of Pub. Wks., for excavation, changing and constructing abutments and constructing new piers in Providence River at Point St. Bridge: (*a*) Tank & McKinnon Constr Co., Providence, $61,543; (*b*) Fred. E. Shaw, Providence, $69,804:

	a	*b*
3,460 cu. yds. excav	$5.00	$3.00
350 cu. yds. riprap	3.00	4.00
480 cu. yds. concrete	7.00	8.00
392 cu. yds. abutment masonry	16.00	30.00
135 cu. yds. cut stone masonry	33.00	50.00
859 cu. yds. pier masonry	24.00	31.50
676 spruce piles	10.50	10.00
46.4 M. ft. hemlock platform	30.00	40.00

Ft. Pierre, S. D.—Bids, including plans and specifications, will be received until Aug. 5 by the Co. Comrs. for constructing a steel bridge for wagon and foot passengers across Bad River, to be 260 ft. long on solid masonry piers; M. P. Kennedy, Co. Aud.

**Dallas Tex.*—It is stated that bids will be received until Aug. 2 by the Co. Comrs. for constructing 6 steel bridges. L. S. Darling, Co. Aud.

**Hoult, W. Va.*—F. H. Clements & Co., of Philadelphia, Pa., are stated to have received the contract for constructing a bridge over the Monongahela River at Hoult for the Baltimore & Ohio R. R. Co., at a cost of $3,000,000.

**Menomonie, Wis.*—C. A. P. Turner, Consulting Engr., Minneapolis, Minn., writes that the contract for constructing the substructure and superstructure of a bridge over Red Cedar River (bids opened Julv 15) has been awarded to Minneapolis Steel & Machinery Co., of Minneapolis, Minn., for $12,300.

Milwaukee, Wis.—Bids will be received Aug. 10 by Geo. Thuering, Co. Treas., for $450,000 Co. viaduct bonds.

**Manitowoc, Wis.*—The contract for constructing a bridge at Manitowoc in connection with the extension of the lines north to Green Bay for the Chicago & Northwestern R. R., is stated to have been awarded to Adolph Green, of Green Bay, for about $60,000.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received by the Bd. of Pub. Wks. on Aug. 15 for 3,500 sq. yds. asphalt pavement; J. N. Hazlehurst, Ch. Engr.

Santa Rosa, Cal.—See "Water."

San Francisco, Cal.—The Bd. of Supervisors is stated to have decided to repave a portion of Valencia St., for $58,275.

Bridgeport, Conn.—W. W. Starr, City Surveyor, writes that the following are the bids opened on July 17 for 13,000 sq. yds. paving: Standish Stone Co., Bridgeport, bid for brick $2.70, $2.58 and $2.45 per sq. yd.; repressed block, $2.70 and $2.45, and for wood block, $3.55; Warren Bros. Co., Boston, Mass., for bituminous macadam, $2.30; Republic Constr. Co., New York, N. Y., for wood block $2.80; B. D. Pierce, Jr., Co., Bridgeport, for repressed block $2.98, $2.65 and $2.49, and brick, $2.75; Dowling & Bottomly, Bridgeport, brick, $2.74; the Barber Asphalt Paving Co., New York, N. Y., bituminous macadam, $2.34½, and bituminous concrete, $2.32; the Silleman & Godfrey Co., Bridgeport, for repressed block, $3 and $2.67; Frank Pidgeon, Saugerties, N. Y., for brick, $2.70, $2.64 and $2.62; repressed block, $2.72, $2.74 and $2.66; wood block, $3.46, and bituminous macadam, $2.68; Burns & Co., Bridgeport, for repressed block, $2.95, $2.63 and $2.57; brick, $2.76 and $2.67, and wood block, $3.25; the Russell Contr. Co., Syracuse, N. Y., for repressed block, $2.75 and brick, $2.65.

Hartford, Conn.—F. L. Ford, City Engr., writes that the following are the bids opened by the Bd. of Street Comrs. on July 19 for constructing a new highway at Albany Ave.; (*a*) amount of bid, (*b*) time at $10 per day; C. W. Blakeslee, New Haven, *a* $13,925, *b* 100 days; Frank Pidgeon, New York, N. Y., *a* $9,469, *b* 100 days: C. W. Blakeslee, New Haven, *a* $13,925, *b* 100 days; Edw. Balf Co., Hartford, *a* $15,317, *b* 100 days.

Wilmington, Del.—Bids will be received until Aug. 5 by the Directors of the Street and Sewer Dept. (L. V. Christy, Secy.) for furnishing materials and paving approximately 20,000 sq. yd. of either sheet asphalt or bitulithic macadam.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Macon, Ga.—About $250,000 will be expended in paving, the material will probably be brick and asphalt; J. W. Wilcox, City Engr.

Peru, Ill.—Bids will be received until Aug. 1 by Emil Shaid for placing a 1-in. asphalt floor on the present concrete floor in the play hall in the Central School, being approximately 4,000 sq. yd.

Danville, Ill.—The Bd. of Local Improv. is stated to have decided to pave Vermilion St., at an estimated cost of $37,000.

Petersburg, Ill.—Jesse M. Ott, Mayor, writes that bids will be received Aug. 1 at 2 P. M. for 8,670 sq. yd. brick paving. Engineer, W. J. Bennett, Petersburg.

Sterling, Ill.—The Local Bd. of Improvements is reported to have decided to expend $31,000 on street improvements.

**Freeport, Ill.*—G. W. Graham, City Engr., writes that the contract for macadamizing Elk St. (bids opened July 19) has been awarded to Wm. Ascher, of Freeport, for $10,846.

Jacksonville, Ill.—All bids opened on July 19 for 8,670 sq. yds. brick paving have been rejected. Wolff, Maupin & Curdie bid $16,200, and Welch & Patterson, of Springfield, $15,994.

Champaign, Ill.—C. D. Stevens, City Clk., writes that it is proposed to pave Randolph St. with brick on broken stone concrete foundation, with cement curb and concrete curb and gutter; probable cost, $52,000. Geo. C. Fairclo, City Engr.

Chicago, Ill.—Bids will be received until Aug. 2 by the Dept. of Pub. Wks. (J. M. Patterson. Comr.) for resurfacing with macadam on a portion of Cornell Ave.

Bids will be received until Aug. 2 by the Bd. Local Improv. (Andrew M. Lynch, Pres.) for grading, curbing and paving with vitrified brick, asphalt or limestone on portions of several streets.

**Rock Island, Ill.*—The McCarthy Improv. Co. is stated to have received the contract (bids opened July 11) for paving with asphalt on a portion of 15th St., at $2.08½ per yd.

Dunkirk, Ind.—Bids will be received until Aug. 7 by the Common Council for improving portions of Main and Center Sts., by grading, curbing, constructing sewers and paving with block; J. O. Sullivan, City Clk.

Scottsburg, Ind.—Bids will be received Aug. 12, by the Bd. Co. Comrs. (Jos. H. Cortner, Chmn.), for constructing about 3 miles Goshen Free Gravel Road; estimated cost, $4,951.

**Columbus, Ind.*—Geo. Vorwald, City Clk., writes that the contract for paving Washington St. with asphalt, bids opened July 20, has been awarded to The Barber Asphalt Paving Co., of Cincinnati, O.

It is stated that bids will be received until Aug. 7 by the Co. Comrs. for constructing about 1 mile of gravel road in Wayne Township. W. A. Morris, Co. Aud.

Evansville, Ind.—It is stated that plans have been prepared and the contract will soon be let for paving with brick on St. Joseph Ave.; estimated cost, $16,500.

Mt. Vernon, Ind.—The Western Constr. Co., of Lafayette, is stated to have received the contract for paving with asphalt about 2 miles of road, at $1.70 per sq. yd., and 55 cts. per lin. ft. for curb and gutters.

Indianapolis, Ind.—It is reported that the Bd. Pub. Wks. will soon receive bids for paving Tuxedo St. with Warren bitulithic pavement.

Bids will be received until Aug. 9 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for grading and paving with brick a portion of Wabash St.; grading, graveling and constructing cement sidewalks on portions of Hartford and Nelson Sts.; also constructing cement sidewalks on portions of Arch St. and Highland Ave.

English, Ind.—It is reported that bids will be received by the Co. Comrs. until Aug. 7 for constructing rock roads in Whiskeyrun Township; Saml. E. McFall, Co. Aud.

Richmond, Ind.—It is stated that bids will be received until Aug. 4 by the Bd. Pub. Wks. for grading, graveling and boulevarding South E St. and constructing cement walks in 14th St.

Terre Haute, Ind.—The following bids are stated to have been received for resurfacing portions of 7th and 5th Sts.: Union Asphalt & Constr. Co., 5th St., $12,276; 7th St., $10,578. W. H. Harris, 5th St., $18,644.10; 7th St., $15,686. Barbour Asphalt Co., 5th St., $12,948.75; 7th St., $11,175.

Napoleon, Ind.—It is stated that bids will be received until Aug. 11 by the Co. Comrs. for constructing roads. F. J. Beck, Co. Aud.

Creston, Ia.—A. W. Schmipff, City Clk., writes in regard to paving 9 blocks with brick, bids for which were to have been opened July 21, that the contract will be awarded Aug. 3.

Atchison, Kan.—The City Council has adopted a resolution providing for paving with brick Kearney St., 2,100 sq. yd. paving and 1,270 lin. ft. curb, and Riley St., 7,184 sq. yd. paving and 4,340 lin. ft. curb. Fred Giddings, City Engr.

Donaldsonville, La.—See "Schools."

New Orleans, La.—Bids will be received by Chas. R. Kennedy, Comptroller, on Aug. 28, for the erection of an asphalt plant, for the repair of asphalt streets, as advertised in The Engineering Record.

Baton Rouge, La.—See "Sewerage and Sewage Disposal."

Baltimore, Md.—Bids will be received until Aug. 2 by the Bd. Park Comrs. (John S. Doyle, Engr. of Parks), for crushed or broken stone.

**Ellicott City, Md.*—The contract for constructing a road near Sykesville is stated to have been awarded by the Howard Co. Comrs. on July 18 to Wm. Davis, Jr., for $5,000.

**Boston, Mass.*—Jas. Doherty, 133 Calumet St., is stated to have received the contract for paving a portion of 3d Ave. with vitrified brick at the Charlestown Navy Yard (bids opened July 15 by Bureau Yards and Docks, Navy Dept., Washington, D. C.), for $21,349.

Detroit, Mich.—The following are reported to be the lowest bids opened on July 17 by Comr. of Pub. Wks. Haarer: Porter St., Seminole and Alexandrine Aves., with Trinidad sheet asphalt: The Barber Asphalt Paving Co., Hammond Bldg., $7,204, $11,190 and $3,109, respectively; Canfield Ave. with Trinidad sheet asphalt, Cleveland Trinidad Co., Rose Bldg., $12,248, and Willis Ave. with cedar block, Michigan Contr. Co., $6,755.

Grand Rapids, Mich.—It is stated that all bids received for improving West Bridge St. hill have been rejected, and, according to reports, new bids will be received. Appleyard, Johnson & Co. are stated to have submitted the lowest bid, $18,000.

Jackson, Mich.—The City Council is stated to have decided to pave several of the streets here, at a cost of $23,000.

**St. Paul, Minn.*—The contract for graveling Point Douglas Road is stated to have been awarded to Jas. Forrestal Co., Pioneer Press Bldg., for $5,070.

*Fielding & Shepley, 216 W. University Ave., are stated to have received the contract for paving with sandstone on a portion of Maria Ave. for $20,150.

St. Louis, Mo.—The following are the lowest bids received July 18 by the Bd. Pub. Improv. for repairing asphalt-paved streets and paving portions of streets, *a* Heman Constr. Co., *b* Fruin & Colnon, *c* Rucking Constr. Co., *d* Granite Bituminous Paving Co.: Maintenance of asphalt streets, Cottage Ave., *a* $209,788 and $30,846, respectively; Palm and Laflin Sts. and Talcott Ave., *b* $32,991, $8,949 and $10,816, respectively; Texas and Sidney Sts., *c* $36,474 and $43,161; Clark Ave., *d* $12,031.

Newark, N. J.—The following bids are stated to have been received for repaving approaches to bridges over the Montclair branch of the Lackawanna R. R.: For the repaving of the Park Ave. approach, Thomas O'Connor, $1.03 sq. yd for telford and $2 for brick; Wm. Van Keuren, $1.03 for telford and $2.40 for brick; J. Roosevelt Shanley, telford $1.10, brick $2.25; Barber Asphalt Co., bituminous macadam, $1.79. For the N. 11th St. and 6th Ave.: J. Roosevelt Shanley, bituminous macadam, $1.85; Warren Bros. Co., bituminous macadam, $2.25; Wm. Van Keuren, brick, $2.40; J. Roosevelt Shanley, brick, $2.25. For the 9th Ave. approach: Wm. Van Keuren, brick, $2.40; J. Roosevelt Shanley, brick, $2.25; Barber Asphalt Co., asphalt, $1.98.

The resurfacing with asphalt on Milford Ave. is reported under consideration.

Orange, N. J.—The Common Council is stated to have passed an ordinance providing for the paving and curbing portions of Hurlbut St. and Parkinson Terrace.

Irvington, N. J.—The Town Council is stated to have passed an ordinance providing for the paving with Warren Bros. bitulithic pavement on a portion of Clinton Ave.

**New Egypt, N. J.*—The contract for constructing a stone road between Allentown and New Egypt is stated to have been awarded to Lecompte & Butcher, of Lakewood, for $22,640.

**Jersey City, N. J.*—John P. Egan, Clk. Bd. Freeholders, writes that the contract for reconstructing and improving a portion of Paterson Plank Road (bids opened July 17) has been awarded to Edw. P. O'Neill, of Jersey City, for about $14,232.

New York, N. Y.—Bids will be received until Aug. 1 by Louis F. Haffen, Pres. Bronx Boro., for paving with asphalt about 1,325 sq. yds. on E. 157 St. with asphalt block laid in concrete foundation; regulating, grading, setting curb stones, flagging, sidewalks, etc., in Creston. Ave., requiring 2,350 cu. yds. rock excavation, 8,850 lin. ft. new curbstone, 32,400 sq. ft. flagging, etc.

Brooklyn, N. Y.—Bids will be received until Aug. 2 by Martin W. Littleton, Boro. Pres., for regulating, grading, curbing and laying sidewalks on Bay 26th St., requiring 14,000 sq. ft. cement sidewalk; for regulating and paving with asphalt about 2,770 sq. yds. on Crescent St., and for repaving about 4,075 sq. yds. on Lafayette Ave., the old stone pavement to be laid as foundation; for curbing on portions of several streets requiring 4,115 lin. ft. curb in concrete.

New Brighton, S. I., N. Y.—Bids will be received until Aug. 8 by Geo. Cromwell, Pres. Richmond Boro., at New Brighton, for furnishing material and constructing flag or cement sidewalks requiring 15,160 sq. ft. flagstone and 3,419 sq. ft. cement sidewalks; also for furnishing and delivering where desired 300 bbl. Portland cement, 360 cu. yd. sand and 55,000 bricks.

**Rochester, N. Y.*—Lauer & Hagaman, 458 S. Clinton Ave., are stated to have received the contract for paving with Metropolitan brick block on Thomas St. for $21,300.

Auburn, N. Y.—Bids will be received until Aug. 7 by the Mayor for paving with either asphalt, bitulithic or bituminous macadam on a portion of Clark St., the portion between the tracks to be paved with fire clay paving brick. F. H. Hosmer, City Clk.

Troy, N. Y.—Bids will be received by the Bd. Contract and Supply (Jas. M. Riley, Clk.) until Aug. 1, for furnishing material and paving with brick on a portion of Mill St., requiring 3,570 lin. ft. curb, 5,100 sq. yds. pavement, etc.

Dallas, N. C.—Bids will be received until Aug. 17 by the Co. Comrs. (A. J. Smith, Clk.) for $300,000 road improvement bonds.

Youngstown, O.—The following bids are reported to have been opened July 15 for paving a portion of Ellenwood Ave.: Jos. McCarron, with brick, $4,126; Harris Heasley, with asphalt, $6,126; Cleveland Trinidad Paving Co., with asphalt, $6,126, and Warren Bros., $7,870.

Norwood, O.—Bids will be received until Aug. 19 by the Bd. Pub. Service (E. R. Edwards, Clk.), for grading, curbing and macadamizing a portion of Marsh Ave.; J. A. Stewart, City Engr., 813 Traction Bldg., Cincinnati, O.

Madisonville, O.—Bids will be received until Aug. 11 by J. A. Conant, Village Clk., for furnishing materials and repairing and resurfacing improved streets. Estimated quantities: Stone, 2,579 cu. yds.; fine crushed stone or screenings, 750 cu. yds.; sprinkling and rolling, 36,000 sq. yds.

Cincinnati, O.—Bids will be received until Aug. 17 by

**Meridian, Miss.*—The following are the bids opened July 17 for brick sidewalks, etc. (Engineer, Waldo G. Myers, Meridian): (*a*) C. H. Dobbs & Co., Meridian; (*b*) C. M. Rubusk, Meridian; (*c*) Fitzgerald & Germany, Meridian. (*d*) Jefferson Contracting Co., Birmingham, Ala. (awarded contract):

	a	*b*	*c*	**d*
35,000 square yards sidewalk, common brick	$0.73½	$0.67½	$0.68½	$0.66⅔
5,000 sq. yds. street crossing, vitri. brick No. 1	1.52½	1.45	1.65	1.40
600 cu. yds. masonry, common brick	8.85	8.50	7.65	8.25
5,000 cu. yds. grading	.30	.24	.28	.26
500 sq. yds. driveways, common brick	1.17½	1.10	1.00	.82
250 c. i. gutter covers	8.00	7.25	7.50	7.50
100 lin. ft. 4-in. drain pipe	.14	.13	.06	.11
500 lin. ft. 6-in. drain pipe	.19	.18	.13	.13
500 lin. ft. 8-in. drain pipe	.21½	.21	.18	.22
200 lin. ft. 10-in. drain pipe	.30	.29	.25	.28
500 lin. ft. 12-in. drain pipe	.38½	.38	.35	.30
200 lin. ft. 15-in. drain pipe	.50	.48	.45	.35
200 lin. ft. 18-in. drain pipe	.67½	.66	.55	.46
200 lin. ft. 20-in. drain pipe	.87	.85	.80	.58
200 lin. ft. 24-in. drain pipe	1.22½	1.21	1.00	.65
1,000 sq. yds. gutters, common brick	1.00	.95	.79½	.89
Total	$44,820	$41,583	$42,331	$40,592

**Items marked thus give the names of parties awarded contracts.*

the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and improving a portion of E. 12th St. by grading, curbing and paving.

**Delaware, O.*—E. S. Mendenhall, County Engr., writes that the contract for grading, draining and macadamizing Rowlands Road (bids opened July 17) has been awarded to Cary & Huston, of Claibourne, for $2,540.

Norristown, Pa.—Bids will be received until Aug. 12 by the State Highway Dept. (Jos. W. Hunter, Comr., Harrisburg) for reconstructing 51,052 ft. of road in Montgomery Co.

**Tyrone, Pa.*—The contract for paving a portion of Pennsylvania Ave. with Park pressed block is stated to have been awarded to the Central Constr. & Supply Co., of Harrisburg, for $2.04 per sq. yd.

Philadelphia, Pa.—The Common Council is stated to have passed an ordinance authorizing the Dept. Pub. Wks. to enter into a contract to pave with asphalt portions of Alden, Beechwood, Blavis, Catharine and other streets; with vitrified clay, shale brick or blocks. Bancroft, Chadwick and other streets.

Pittston, Pa.—Bids will be received until Aug. 3 for paving a portion of B'way and Front St.; J. T. Flannery, City Clk.

**Dorrancetown, Pa.*—The contract for grading, curbing and paving with brick and macadam on a portion of Market St. is stated to have been awarded on July 22 to the West Newcomb Co., of Philadelphia, for $11,920.
The Scranton Vitrified Brick & Tile Co., of Scranton, is stated to have received the contract for furnishing 290,000 brick at $18 per M.

**Pittsburg, Pa.*—The County Comrs. are stated to have opened on July 18 the following bids for constructing, *a* Versailles Road, *b* Elizabeth and Monongahela City Road, *c* Loomis Run and Mt. Nebo Road, *d* Three Degree Road, *e* Noblestown Road: W. W. Kelly, *a* $11,922, *b* $34,412, *c* $77,496, *d* 39,117 (awarded contract), *e* $61,985 (awarded contract); Howley Constr. Co., *a* $12,994, *b* $28,550, *c* $72,350 (awarded contract), *d* $54,801, *e* $98,567; W. E. Howley, *a* $15,625, *b* $22,760 (awarded contract), *c* $61,465 (awarded contract), *d* $46,966, *e* $70,729; Booth & Flinn, *a* $18,990, *b* $41,370, *c* $74,175, *d* $50,911, *e* $78,370; Keeling & Ridge, *a* $19,395, *b* $49,840, *c* $82,325, *d* $50,510, *e* $83,225; McLaughlin Co., *b* $36,750; Ott Bros., *b* $40,910, *c* $95,840, *d* $74,738, *e* $84,270; Ancorian Co., *b* $41,165; Hill Constr. Co., *c* $107,286, *d* $80,902, *e* $125,705; C. M. Driver, *d* $60,109, *e* $91,620; Zelt Bros., *e* $91,990; Folev Bros., $67,118.

Knoxville, Tenn.—Bids will be received until Aug. 8 for paving Walnut, Church and Main Sts. and 5th Ave. T. J. Moreland, City Engr.
Contracts will be let in about 4 weeks for 40,000 sq. yd. asphalt or brick.
*J. E. Borches & Co., of Knoxville, are stated to have secured the contract on July 21 for paving with brick Asylum St., 10,000 sq. yd., at $1.64½ per sq. yd.

Harriman, Tenn.—The Roane County Court is stated to have appropriated $30,000 for constructing 16 miles of pikes between Harriman and Oliver Springs and Kingston and Rockwood.

Nashville, Tenn.—The citizens voted, July 20, to issue $500,000 bonds for macadam streets.

**Norfolk, Va.*—The contract for constructing roadways on the site of the Jamestown Exposition is stated to have been awarded to Mundy & Co., of Newport News, for $4,996.

Seattle, Wash.—Bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., until Aug. 5, for wooden sidewalks on Grand Boule. and other streets, to cost about $31,600.

Tacoma, Wash.—The City Council is stated to have passed an ordinance providing for the construction of semi-concrete walks on South G, N. 26th Sts., N. Tacoma Ave. and other streets.

**Milwaukee, Wis.*—The Badger Constr. Co., 105 Grand Ave., is stated to have received the contracts for paving with Kettle River sandstone on a portion of Galena St. at $2.82 per sq. yd., also for paving a portion of Muskego Ave. at $1.72 per sq. yd.

**Elmira, Ont.*—J. H. Ruppel, Village Clk., writes that the contract for 21,000 sq. ft. granolithic sidewalks (bids opened June 26) has been awarded to S. J. Barlow & Co., of Guelph, at 8¼ cts. per sq. ft.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Luxora, Ark.—The Town Council is reported to have granted Wm. and C. B. Wood a franchise for an electric light plant.

Washington, D. C.—Bids will be received Aug. 28 at the office of the Comrs. D. C. (Henry B. F. MacFarland, Comr.), for furnishing and erecting switchboards, tablet boards and cabinets for the electric plant at the sewage pumping station, as advertised in The Engineering Record.

Washington, D. C.—Bids will be received until Aug. 8 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, etc., Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies, as follows: Motors, electrical conductors, cable, brass and steel conduits and fittings, boilers, hydraulic jacks, Pratt & Whitney turret lathes, curbstone, asphalt paving blocks, building brick, radiators, etc., for hot water heating system. H. T. B. Harris, Paymaster Gen., U. S. N.

Pensacola, Fla.—Bids will be received until Aug. 8 by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard, Pensacola, electrical supplies, telephone wire, cable, etc.

Deland, Fla.—John H. Kruse has petitioned for a franchise for a gas plant.

Cochran, Ga.—The citizens are reported to have voted July 18 to issue $17,000 bonds for electric lights and new water mains.

Thomasville, Ga.—The City Council is stated to have granted the Municipal Investment Co., of Chicago, Ill., and Columbus, Ga., a franchise for an electric light plant.

Ft. Gaines, Ga.—Eugene E. Gaddis, Secy. Interstate Water Wks. & Constr. Co., of Washington, D. C., which recently secured a franchise for water works and an electric light plant at Ft. Gaines, writes that this company expects shortly to take bids for the construction of several water works and electric light plants. Nothing definite has yet been done.

Cordelia, Ga.—John P. Emerson, an electrical engineer, is reported to be preparing plans for an electric light system in Cordelia and other places.

Sparta, Ill.—See "Electric Railways."

Waukegan, Ill.—The City Council has adopted a resolution authorizing H. Thacker, City Clk., to procure bids for furnishing 200 arc lamps, 5-ampere, for street lighting on a 3, 5 or 10-yr. contract, bids to be presented to Council at its first regular meeting in August.

Pekin, Ill.—Bids will be received until Aug. 15 by J. B. Reynolds, Acting Secy., Treas. Dept., Washington, D. C., for furnishing and installing in the U. S. Post Office, at Pekin, certain combination electric and gas light fixtures.

**Divernon, Ill.*—D. H. Garvey, Village Clk., writes that the contract for constructing an electric light plant (bids opened July 15) has been awarded to the Ft. Wayne Electric Co., Lincoln Trust Bldg., St. Louis., Mo., for $7,672.

Ft. Wayne, Ind.—Geo. W. Beers and H. G. Keegan are reported interested in the construction of a heating plant.

North Manchester, Ind.—Dr. D. Ginther and others are reported interested in the construction of an electric light plant at this place.

Claremore, Ind. Ter.—The Claremore Light & Power Co. has been incorporated, with a capital of $25,000. Incorporators: J. M. Bayless, F. A. Neilson, W. W. Bryan and others.

Sumner, Ia.—L. L. Stewart is stated to have secured a franchise for an electric light and power plant.

**Wichita, Kan.*—The Wichita Railroad & Light Co. is stated to have secured the contract for furnishing 271 arc lights for 5 years at an annual cost of $14,454. Each light will be run with a power of 460 watts and be lighted at dusk and burn until 1 o'clock. The company will furnish additional lights at $66 per light per year.

Somerset, Ky.—Dr. W. Godfrey Hunter is reported to have purchased the plant of the Somerset Water Wks. Co., and is now negotiating for the electric light plant and electric street railway franchise.

Russell, Ky.—E. E. Fullerton, of Greenup, writes that bids will be received until Aug. 15 for the construction of an electric light plant at Russell; probable cost, $5,000.

Marksville, La.—Bids will be received until Aug. 24 by the Mayor and Bd. of Aldermen for constructing a system of water-works and electric light. Ira W. Sylvester, Engr., Alexandria, La.; C. Ashton Smith, Mayor.

Waterville, Me.—The Messalonskee Electric Co. is reported organized, with a capital of $250,000, with Harvey D. Eaton, of Waterville, Pres.; J. N. Webber, Vice-Pres., and E. L. Meader, Secy.

Annapolis, Md.—Andrew Westervelt, Secy. Maryland Heat, Power & Light Co. writes that about $40,000 will be expended in improvements. Howard E. Crook, Pres.

Warren, Mass.—The Worcester County Gas Co. has petitioned for a franchise to lay its mains through Warren.

New Boston, Mass.—Engr. H. F. Keith, of Mt. Washington, Mass., with a corps of engineers, is reported to have arrived at New Boston, to make surveys and ascertain the cost of an electric power plant, a charter for which is reported to have been granted by the recent Connecticut Legislature. The company proposes to sell and transmit electric power to various cities in Massachusetts and Connecticut.

Escanaba, Mich.—The Bd. of Pub. Wks. is reported to have petitioned Council for an appropriation of $14,000 to purchase additional machinery for the electric light plant.

Pontiac, Mich.—The Clinton River Power Co. has been incorporated, with a capital of $75,000, to furnish electricity for heat, light and power purposes. The company is reported to have secured a franchise and will develop 1,500 h.p. on Clinton River.

**Saginaw, Mich.*—The Barlett Illuminating Co. is stated to have secured the contract for lighting the city for 5 years, at $60 per light per year.

**Ann Arbor, Mich.*—The City Council is reported to have awarded to the Washtenaw Light & Power Co. the contract for lighting the streets for 5 yrs. at $63 per light per year, all night and every night.

Browns Valley, Minn.—E. R. Marshall, City Recorder, writes that a committee has been appointed to investigate the question of constructing an electric light plant.

Duluth, Minn.—It is reported that plans are under consideration for the construction of a gas pipe line from Duluth to St. Paul and Minneapolis. The Zenith Blast Furnace Co., of Duluth, is said to be interested.

Pontotoc, Miss.—The citizens are reported to have voted July 18 to issue bonds for the construction of an electric light plant.

Jackson, Mo.—Bids will be received until Aug. 7 for $27,000 water and light bonds. Wm. Paar, City Clk.

**New York, N. Y.*—The Plymouth Electric Co. has secured the contract for the electric equipment of School 10, Bronx Boro. (bids opened July 24) for $6,694.

**North Tonawanda, N. Y.*—The Tonawanda Power Co., of North Tonawanda, has secured the contract for lighting the city (bids opened July 1) at $75 per arc light per yr. for a term of 2 years.

Lake Placid, N. Y.—Bids will be received until Aug. 3 for constructing a masonry dam, power station and foundation, a 150-kw. and a 100-kw. alternating-current generator, a 225-hp. and a 150-hp. water wheel, a 200-hp. steam engine and all other station equipment; also all poles, wire, transformers, etc.; also for a storage reservoir and pipe line, as advertised in The Engineering Record.

Arcanum, O.—The following are reported to be the bids opened on July 6 by the Bd. of Public Affairs for the construction of water-works and an electric light plant: Ryan Constr. Co., Indianapolis, Ind., $37,000; Baker, Niswonger & Warner, Arcanum, $34,914; P. H. Porter, Clinton, Ky., $34,816, and the Olds Constr. Co., Ft. Wayne, Ind., $34,743.

Toledo, O.—The Toledo Gas Light & Coke Co. and the Toledo Htg. & Lighting Co. are reported to have been consolidated, as the Toledo Gas, Electric & Htg. Co., with a capital of $2,500,000. It is stated that $250,000 will be expended in improvements.

Ft. Stevens, Ore.—The lowest bid opened in July 20 by Capt. Geo. L. Goodale, Q. M., U. S. A., at Astoria, for electric light work at Ft. Stevens, was submitted by the Northwest Electrical Eng. Co., of Portland, for $5,725.

Oregon City, Ore.—The Portland General Electric Co. is reported to be arranging to construct a 40-h.p. plant on the east side of Willamette River in Oregon City, just below the falls. E. Hippeley, Ch. Engr., Portland.

Pittsburg, Pa.—H. P. Dilworth, of the Dilworth Coal Co., and Chas. Arbuckle Jamison, of Arbuckle & Co., and Stewart Robinson, a realty dealer, are reported to have secured from the U. S. Secy. of War the right to use water flowing over Springdale dam, in the Allegheny River, for power purposes. It is reported that a $400,000 plant will be constructed and power will be furnished for the traction roads in Allegheny Valley, and power and light lines will be extended to Tarentum, New Kensington, Oakmont, Creighton, Natrona and Parnassus.

Columbia, S. C.—The Columbia Electric Street Ry., Light & Power Co. is reported to have taken over the Columbia Water Power Co. Among the improvements contemplated is the relaying of rails on Main St., the entire overhauling of the electrical appliances and the thorough equipment of the entire plant. Extensive improvements and additions to the power plant are also contemplated. The new officers include Edwin W. Robertson, Pres., and W. M. Shannon, electrician.

Bolivar, Tenn.—Bids will be received until Aug. 10 for furnishing material and machinery required for the proposed water and light plant. Specifications may be secured from Granbery Jackson, Engr., Nashville, Tenn.; R. C. Wilkinson, Mayor.

Llano, Tex.—John W. Maxcy, Designing Engr., of Houston, writes in regard to the construction of a power plant on Llano River, and a system of irrigation, that the probable cost of the proposed work is $85,000, and will include masonry dam 900 ft. long and 18 ft. high; penstocks; 2 turbines; draft tubes; electric generator; electric transmission line; 200-hp. developed for lights, water works, etc.

Ft. Myer, Va.—Bids will be received by Capt. B. B. Hyer, Q. M., U. S. A., on Aug. 19 for enlarging gas main at Ft. Myer, as advertised in The Engineering Record.

Provo, Utah.—The citizens are reported to have voted to issue $91,000 bonds, to be used for the completion of the water works and the construction of a municipal electric light plant.

Pulaski, Va.—John F. McKee, Mayor, writes that bids will be received on Aug. 15 for the construction of a building and new machinery for a 150-kw. dynamo. The present plant, 75-kw. dynamo, engine and boiler, will be for sale as soon as new plant is complete.

Granite Falls, Wash.—O. Lewis, of Snohomish, is reported to have secured a franchise for an electric light plant.

Winnipeg, Man.—The Civic Power Com. is stated to have selected Cecil B. Smith, M. E., to make preliminary investigation of the various sources of power available for the use of Winnipeg.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Tucson, Ariz.—It is stated that an electric street railway system will be built in Tucson by W. S. Iliff and C. K. Durbin, Pres. and Vice-Pres., respectively, of the United States Light & Traction Co., of Denver.

Oroville, Cal.—It is reported that the Northern Electric Co., an electric railway from Oroville to Chico, has been fully financed and will be built. The Northern Electric Co. has purchased the Chico Electric Co., which will be run in connection with the Oroville electric line. The rights of way are now nearly closed. The road will be 26 miles long.

Santa Rosa, Cal.—It is stated that the Petaluma & Santa Rosa Electric Ry. will be extended to Occidental, Camp Meeker and the western coast of Sonoma County. E. H. Rollins, of Boston, is understood to be interested.

Hollister, Cal.—An ordinance is stated to have been passed granting a franchise to J. C. Kemp to build an electric railway over certain routes and highways in the county of San Benito.

Sacramento, Cal.—The Supervisors are stated to have granted to John Martin, owner of the Bay Counties Power Co. and the Sacramento Electric, Gas & Ry. Co., a franchise to run an electric railway down the Riverside Road, leading out of this city. It is the intention to extend the road into the fruit-growing district south of Sacramento.

San Francisco, Cal.—The Ocean Shore Ry. Co. has decided, according to reports, to build an electric railway to connect San Francisco and Santa Cruz.

Hartford, Conn.—The Hartford & Springfield St. Ry. Co. is stated to have voted to purchase the Rockville, Broad Brook & East Windsor Road and to build the same at once. The contract for building was awarded to the National Constr. Co., of New York. William A. Tucker, Pres.; Arthur Perkins, Secy.; Chauncey Eldridge, Treas.; Henry S. Newton, Supt.

Rockville, Conn.—The Rockville, Broad Brook & East Windsor St. Ry. Co. is stated to have in contemplation the building of a street railway from Rockville through Ellington, Melrose and Broad Brook and to connect with the Hartford & Springfield St. Ry. at Warehouse Point. The line will be about 14 miles in length and will be operated by the Hartford & Springfield management The company will meet the line of the Hartford, Manchester & Rockville Tramway Co. at West and Union Sts., in Rockville.

**Items marked thus give the names of parties awarded contracts.*

Jacksonville, Ill.—The Jacksonville St. Ry. Co. is reported to have been granted a franchise to operate a line from the intersection of E. State St. and Illinois Ave., east to the end of E. State St.

Sparta, Ill.—J. M. Jenkins, Gen. Mgr. of the National Constr. Co.; Geo. K. Kobusch, Pres. St. Louis Car Co., and others are stated to have under consideration the construction of telephone, electric light, gas service, water works, and a trolley car system.

Chicago, Ill.—Local press reports state that A. B. Dupont, of Detroit, Mich., has been selected to prepare plans for a municipal system of street railways for Chicago.

Muskogee, Ind. Ter.—It is stated that the Muskogee St. Ry. & Power Co. will apply to the City Council for a franchise. O. L. Reeves, Pres. Capital, $40,000.

Warsaw, Ind.—The City Council is reported to have granted a 50-year franchise to the Indiana Northern Traction Co. to enter the city.

Kendallville, Ind.—The citizens of Wayne Township are stated to be in favor of the Toledo & Chicago Ry. Co. constructing its line.

Ft. Wayne, Ind.—It is reported that the Ft. Wayne & Wabash Traction Co. is asking for bids for the construction of a power plant in this city, to cost about $1,000,000.

Sioux City, Ia.—The Sioux City & Ireton Interurban Ry. Co. (O. J. More, Pres.) is stated to have decided to employ at once a competent engineer to make the locating survey of the proposed route from Sioux City to Ireton.

Council Bluffs, Ia.—At a meeting of the promoters of the Council Bluffs & Eastern Pottawattamie County Electric Ry. a preliminary organization is reported to have been formed under the name of the H. H. Van Brunt Co. The parties associated with Mr. Van Brunt in this enterprise are H. A. Quinn, C. W. McDonald, Congressman Walter I. Smith, E. H. Merriam and others, all of Council Bluffs. At the meeting it was also decided to order the completion of the survey east of Carson to Griswold at once.

Lexington, Ky.—The Lexington Southern Ry. Co., with a capital of $3,600, is reported formed to construct interurban electric lines to connect this city with surrounding towns. The purpose of the company is to construct an electric railway between Lexington and Nicholasville, and to furnish heat, light and power to persons and corporations en route between the points mentioned. It is also proposed that the company shall operate a line to Camp Nelson and High Bridge and that the headquarters of the company shall be in this city. J. W. Stoll, President; E. B. Ellis, Secy. and Treas.

Lake Providence, La.—The Lake Providence & Gouldsboro Ry. Co., Ltd., is stated to have entered into a contract with A. B. Sanders, of Shreveport, to build and equip a 3-mile electric railway, from the river to the town, and to Gouldsboro.

Boston, Mass.—Rockland's Selectmen are stated to have granted the Old Colony St. Ry. Co. the right to lay a double track on Union St. from the railway station to the head of Webster St. in Rockland.

Pittsfield, Mass.—The Pittsfield St. Ry. Co. directors are stated to have voted to authorize P. H. and P. C. Dolan to build a new power house upon the recently purchased Seymour St. property. The new plant will cost about $100,000. Engr. C. K. Stearns, of Boston, is preparing the plans.

Springfield, Mass.—Steps are stated to have been taken toward the building of the Bircham Bend Road from Indian Orchard to Chicopee Falls. J. K. Pundeford, of New Haven, Conn., Supt. of Constr.

**Joplin, Mo.*—President A. H. Rogers, of the Southwest Missouri Electricity Co., is stated to have announced that the company will at once begin an extension of the line from Webb City to the Northwest, passing through Orenoge, Neck City, Purcell and Alba, and connecting with the eastern end of the old line at Carthage, thus forming a loop. The contract for building 2,200 ft. of bridges is reported to have been let to the Reinforcement Concrete Constr. Co., of St. Louis.

Las Vegas, N. M.—The Las Vegas Electric Ry. Co., W. A. Buddeke, Pres., which has 12 miles of line in operation, announces the voting of $100,000 for extensions, a new power house and additional cars. The machinery for the power house and four new cars have been ordered. The extension, which will complete a belt line around the city, is to be commenced at once.

Clinton, N. Y.—F. K. Baxter, of Utica, has completed maps and profiles for an electric railway from Clinton to Waterville, a distance of 11 miles, and in connection with the same he has completed maps, plans and estimates for water power to generate the necessary electricity. A company will probably be formed, and work on construction commenced this fall.

Oneida, N. Y.—It is reported that the Oneida Ry. Co. has practically decided upon the extension of its line from Oneida to Sylvan Beach, Oneida Lake, the branch to be operated only in the summer.

Auburn, N. Y.—The Auburn & Ithaca Traction Co. is reported incorporated with a capital of $400,000 to operate an electric railway 40 miles long between Auburn and Ithaca. Directors: Sherman Collins, Ithaca; E. B. Mosher, and I. P. Hazard, Poplar Ridge.

Shawnee, Okla. Ter.—The Oklahoma Electric Ry. Co. is reported organized at Tecumseh, July 17, with a capital of $250,000. Alfred Hare, Pres.; Chas. Blickensderfer, Secy. and Treas. The purpose of the company is to establish an interurban line between Tecumseh and Shawnee.

Wilkinsburg, Pa.—The Pittsburg Ry. Co. is said to be the sponsor for the new company, which has been formed with J. D. Callery and Senator Wm. Flinn as chief promoters for the construction of an electric railway from Wilkinsburg and Turtle Creek.

Scranton, Pa.—The Scranton, Factoryville & Tunkhannock Ry. Co. is stated to have sold its franchise to the Northern Ry. Co. The franchise gives the right to construct a road through West Market St., this city, through the Abingtons to Factoryville, Lake Winona and on to Tunkhannock. W. L. Connell is President of the Northern Co.

Philadelphia, Pa.—It is stated that the Philadelphia & Garretford St. Passenger Ry. Co., having obtained the required franchises through the borough of Clifton, as well as all rights of way necessary, the company will begin the work of constructing the line from a point of connection with tracks of the Philadelphia & West Chester Traction Co., near 63d and Market Sts., along the Garretford Road to Clifton. The line will be double tracked.

*Millard & McGraw Constr. Co., of Philadelphia, is stated to have been awarded the contract for the reconstruction of a portion of the Ardmore & Llanerch St. Ry., and the extension of its tracks. In the important work planned are the elimination of a sharp reverse curve, the straightening of the tracks in Ardmore and the double tracking of a portion of the line.

A company known as the Ashbridge Syndicate, of which Knowles L. Perot, of Lower Merion, is president, is reported to have asked West Conshohocken Town Council the probability of getting permission to build an electric railway through that borough. While no ordinance has been submitted, the members of Town Council who were consulted suggested that the Borough Solicitor and the solicitor of the trolley company get together and draw up an ordinance which will be acceptable to both, and submit it at the September meeting of Town Council. The company owns an electric railway in Pottstown that has been in operation for a number of years. Recently it endeavored to get permission to extend this line to Reading, but was refused by the Town Council of that town because the Schuylkill Valley Company came along and offered better terms. The company also owns a line running from Spring City to Phœnixville. This line has been in operation about four years. The company has a franchise through Lower Merion from Bala to the West Conshohocken line. The line starts at the city line at Bala and terminates at West Conshohocken.

Harrisburg, Pa.—The State Department is stated to have issued charters to 7 street passenger railway companies in the vicinity of Pittsburg, with a total capital of $100,000. They are as follows: The Ambridge, Edgeworth & Sewickley; Ambridge, Sewickley & Osborn; Ambridge, Dixmont & Emsworth; Ambridge, Osborne & Haysville; Ambridge, Haysville & Glenfield; Ambridge, Glenfield & Dixmont; Ambridge, Leetsdale & Edgeworth.

Columbia, S. C.—See "Power Plants, Gas and Electricity."

Memphis, Tenn.—It is reported that Thos. Taggart, Hugh J. McGowan, J. M. Jones and several other well-known men are interested in a plan to build an electric railway from Memphis to Clarksdale, Miss., a distance of 75 miles.

North Yakima, Wash.—The Northern Pacific Ry. Co. is reported to have decided to construct an electric railway through the Yakima Valley.

Wheeling, W. Va.—A corps of engineers is stated to have commenced work on the proposed electric railway from Wellsburg to Bethany, and it is quite likely that a right of way will be secured along the Bethany Pike all the way between the two towns. The enterprise is backed principally by Pittsburg capitalists, and J. A. Lazear, of Wellsburg, and other prominent business men of that city are also said to be interested.

Nicaragua.—A concession is reported to have been granted to a California syndicate, known as the Nicaragua Finance & Improvement Co., to construct a railway from Sabana Grande to Matagalpa and Jinotega. Branches are to be constructed to Esteli and to Boaco to connect with the proposed line now being surveyed from San Miguelito to Monkey Point. Length of line will be about 458 miles. The company also has the privilege of generating electricity for use on its railways from the Tipitapa Falls. The company also has an additional concession which gives it an exclusive right to construct an electric railway from Manague or Masaya to Tipitapa. Fred M. Rider, Consul, San Juan Del Norte, Nicaragua.

RAILROADS.

Notes Arranged Alphabetically by States.

Lewisburg, Ala.—The Seaboard Air Line R. R. (W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.) is reported to be seeking right of way for an extension to Lewisburg, a distance of about 5 miles.

Leslie, Ark.—A charter is stated to have been granted to the Southeastern Arkansas R. R., to build a line from Leslie, Ark., the present southern terminus of the St. Louis & North Arkansas R. R., to a point in Lonoke County, with a branch to Little Rock, a distance of about 141 miles. David F. Francis, of St. Louis, and John Scullin, 818 Security Bldg., St. Louis, Mo., Pres. of the St. Louis & North Arkansas R. R., are among the directors.

Napa, Cal.—The California Northwestern Ry. Co. (F. K. Zook, Ch. Engr., Tiburon, Cal.) is reported to have decided to extend its present line from Napa up the valley to St. Helena and Calistoga.

Greenwich, Conn.—Engineers are reported to have resumed work in Greenwich on July 24 on the New York & Ridgefield R. R. The line as laid out extends from Portchester to Danbury, a distance of 31 miles. Leaving Portchester, the survey passes through the western and northern parts of the town of Greenwich to Scott's Corners and from there to Ridgefield and Danbury. W. L. Jenks, Ch. Engr. Work of construction will soon commence.

Miami, Fla.—Bids will be received by J. C. Meredith, Constructing Engr., Florida East Coast Ry. Co., on Sept. 9, for the construction and completion of reinforced concrete arch work, about 45,000 cu. yd. at Knights Key Channel, 45,000 cu. yd. at Moser Channel and 35,000 cu. yd. at Bahia Honda, as advertised in The Engineering Record.

Roodhouse, Ill.—The Central Illinois Ry. Co. is reported incorporated, with principal office in Chicago; capital, $50,000. A road is to be constructed from Roodhouse in an easterly direction through the counties of Greene, Morgan, Sangamon, Christian, Shelby, Moultrie, Coles and Edgar to Paris. Incorporators: A. W. Underwood, Evanston; Nathan S. Smyzer, M. S. Somerville and others, of Chicago.

New Augusta, Ind.—The Big Four R. R. (G. W. Kittredge, Ch. Engr., Cincinnati, O.) is reported to have decided to construct a 5-mile line to start 1 mile south of New Augusta on the Big Four main line, and extend directly south through Wayne and Pipe townships to connect with the Peoria division.

Arkansas City, Kan.—The citizens are reported to have voted to issue $45,000 bonds to aid in the construction of the Midland R. R. Grading is in progress between Silverdale, Kan., and Pawhuska, Okla. Ter. From Silverdale the road will come directly into Arkansas City and from here will probably be built on to Wichita.

Shreveport, La.—Bids will be received at once for building an incline at Naples on the Red River and another incline on the Mississippi River at Angola, both for the Louisiana Ry. & Navigation Co., of Shreveport. There will be required about 65,000 lin. ft. of hewn cypress piling and 800,000 ft. B. M. of long-leaf yellow pine. The inclines will descend on a 3½ per cent. grade. The La. Central Constr. Co. will furnish hewn or round pine piling. A separate bid is wanted for planing and driving the piling. Bids are also wanted for constructing the necessary cradles and aprons, which will require about 125,000 ft. B. M. Address D. C. Fenstermaker, Ch. Engr., La. Central Constr. Co., Ltd., Shreveport.

Lake Charles, La.—The St. Louis, Watkins & Gulf R. R., of St. Charles, is reported to have been sold to the Gould system. It will build a connecting line from Lake Charles to Houston.

Opelousas, La.—The Opelousas, Gulf & Northeastern R. R. Co. (Thos. H. Lewis, Pres.) is reported to have completed preliminary surveys and that portion of the route running to Crowley and Abbeville is stated to have been definitely agreed upon and the company will at once commence securing right of way through that section. The route of the proposed road lying northeast of this town has not yet been decided upon.

**Alberton, Md.*—The contract for the construction of about 3 miles of new track on the main line of the Baltimore & Ohio R. R. between Hollofields and Alberton is stated to have been awarded to Thos. A. Shoemaker & Co., of Pittsburg, Pa. This is the continuance of the work of straightening the alignment and making a low grade freight line from Relay to Washington Junction, upon which more than $2,000,000 has already been spent. This improvement will cost between $600,000 and $700,000 and the contractors will begin work at once. It will be a standard double-track line, including one tunnel 1,000 ft. long and another 500 ft. long.

New York, N. Y.—The Mayor on July 18 approved the ordinance providing for an issue of $750,000 bonds for the purpose of abolishing the grade crossings on highways and railroads, which resolution was adopted by the Bd. of Estimate and Apportionment March 31.

Oklahoma, Okla. Ter.—The Oklahoma City Terminal Assoc. of Oklahoma City has been incorporated, with a capital of $150,000, to construct and maintain a terminal railroad grounds from a point 2 miles northwest of Oklahoma City, through the city to South Oklahoma, a distance of about 6 miles of railroad, with passenger depot, freight depots, sidetracks and spurs; estimated cost, $300,000. Directors: T. D. Turner, J. H. Wheeler, J. L. Wilkin, W. W. Bierce and others, all of Oklahoma City.

Elgin, Ore.—The Oregon R. R. & Navigation Co. (J. B. O'Brien, Gen. Supt., Portland) is stated to have decided to build from the terminus of the Elgin branch east to Joseph, about 65 miles in length.

Erie, Pa.—B. E. Briggs, City Engr., writes that the question of abolishing the grade crossings and erecting a new union station is being discussed. Probable cost of work is $200,000. The Grade Crossing Comn. for the city is M. Liebel, Jr., B. B. Nagle and Frank Connell. E. A. Handy, Cleveland, O., is Ch. Engr. of the Lake Shore & Michigan Southern Ry. Co., which is also interested.

Norfolk, Va.—C. O. Haines and Adam Tredwell, of Norfolk, formerly Gen. Mgr. and Secy., respectively, of the old Atlantic & Danville R. R., are reported to be directors of the new North Carolina & Ohio R. R. Co., just organized to construct a standard gauge railroad from Central North Carolina to the coast, via Little Washington, N. C.

Marshfield, Wis.—The Wisconsin Central R. R. Co. (C. N. Kalk, Ch. Engr., Milwaukee) is reported interested in the construction of a line from Marshfield through Ladysmith, to the head of the Lakes.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Connecticut.—The following bills have been passed by the Legislature: Appropriating $20,000 for a contagious ward at Connecticut Hospital for the Insane at Middletown; $25,000 for 7 fireproof vaults in the Capitol building; authorizing purchase of land and the erection of a town hall in Stamford and issue $230,000 in bonds; authorizing city of New London to issue $100,000 municipal building bonds and the city of Waterbury $50,000 city hall bonds.

**Hartford, Conn.*—Wm. F. O'Neil, it is stated, has secured the contract to erect the House of the Good Shepherd for the Sisters of the Good Shepherd on Susson Ave., at a cost of about $100,000. John J. Dwyer, 78 Turnbull St., is the architect.

Westport, Conn.—Morris K. Jesup, it is stated, has given $20,000 to this city with which to erect a library.

**Washington, D. C.*—Thos. Ryan, Acting Secy. Dept. of Interior, writes that the contract for the construction of the new Freedmen's Hospital at Washington (bids opened June 29) has been awarded to the Geo. A. Fuller Co., Home Life Bldg., Washington, for $277,300.

*W. E. Mooney, of Washington, has secured the contract for erecting the fire boat house, bet. M and N Sts., on the river front, for about $10,388.

The following are reported to be the bids opened on July 20 at the office of the Quartermaster of the U. S. Marine Corps for the erection of an addition to the marine barracks in this city, to include band room, mess hall, gymnasium, guard room, prison and amusement room (bidders of Washington, D. C., unless otherwise stated): Fissell & Wagner, $101,200; Lipscomb & Co., $90,195; W. E. Spier & Co., $93,500; Chas. McCaul Co., of Philadelphia, Pa., $91,126, and Cramp & Co., of Philadelphia, Pa., $92,000.

Wallace, Idaho.—August Ilse, of Spokane, Wash., it is stated, submitted the lowest bid for erecting the courthouse at $68,495.

**Benton, Ill.*—The Co. Bd., it is stated, has awarded

**Items marked thus give the names of parties awarded contracts.*

the contract to erect a jail to R. Z. Gill, of Urbana, at $22,700.

Evanston, Ill.—Phillips, Rogers & Wyatt, of Chicago, it is stated, are preparing plans for a 3-story maternity hospital to be erected at 2650 Ridge Ave. at a cost of $40,000.

Chicago, Ill.—The city will build a 2-story police station at Blackhawk St. and Hudson Ave. at a cost of $20,000.

Dr. M. H. McKillop will build a veterinary hospital at 1639 Wabash Ave. after plans by Patton & Miller, 140 Dearborn St. The building will be 2 stories high, 35x160 ft. and cost about $25,000.

Bids will be received until Aug. 11 by Dept. Pub. Wks. (J. M. Patterson, Comr.) for erecting a 2-story and basement brick engine house at Harrison and Laflin Sts. Bids on the following to be submitted separately: Plumbing, sewerage, gas fitting and electric wiring; carpenter work; and mason, concrete, iron and cut sheet metal work, steel ceilings and gravel roofing; stone work.

St. Charles, Ill.—Jenney, Mundie & Jensen, 171 La Salle St., Chicago, are preparing plans for improvements to be made in connection with the St. Charles Boys' Home, at St. Charles. The Bd. of Trus. has just decided to erect a manual training school and 3 more cottages. The cost of the new work will be about $110,000.

Seymour, Ind.—The City Council has accepted plans for a city building and fire department house, to cost $15,000.

Huntington, Ind.—It is stated that bids will be received until Sent. 4 by Geo. S. Morris, Co. Aud., for installing a complete ventilating, heating, plumbing and sewerage system for the new courthouse.

**Grafton, Mass.*—Ernest T. Wilson, of Natick, is stated to have secured the contract for erecting a hospital at Grafton, for about $56,644. Fuller & Delano Co., Archts., Worcester.

**Ft. Warren, Mass.*—The Wheaton Bldg. & Lumber Co., of Putnam, Conn., is the lowest bidder for building a torpedo storehouse at Ft. Warren (bids opened July 17) at $11,950.

Ft. Revere, Hull, Mass.—John A. Rooney, 95 Milk St., Boston, is reported to be the lowest bidder for buildings at Ft. Revere (bids opened July 21) for $15,680.

Monson, Mass.—Separate bids will be received until Aug. 2 by the Trus. Massachusetts Hospital for Epileptics (Wm. N. Bullard, Chmn.) for plumbing and heating a building for 100 patients at Monson. Kendall, Taylor & Stevens, Archts., 93 Federal St., Boston.

**Marquette, Mich.*—The Lake Superior Steam Heating Co., of Ishpeming, it is stated, has secured the contract for the installing of a complete heating and generating plant at the branch prison, the cost to be about $7,175.

Stanton, Mich.—Bids will be received until Aug. 1 by the Co. Comrs. for repairing and rebuilding the court house here. Edwin A. Bowd, Archt., Lansing; Chas. L. Meach, Co. Clk.

South Haven, Mich.—It is stated that bids will be received until Aug. 1 by W. W. Holmes, Secy. Bd. Library Directors, for erecting a library. Albert Randolph Ross, Archt., 542 5th Ave., New York City.

Crookston, Minn.—It is stated that bids will be received until Aug. 15 by the Co. Bd. for constructing an addition to the Polk County Jail. N. A. Hoffard, Co. Aud.

Gloster, Miss.—See "Water."

Portsmouth, N. H.—Bids will be received until Aug. 19 by Mordecai T. Endicott, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a fireproof building and installing elevator, electric lighting, plumbing and hot water heating, and cell work at the Navy Yard, Portsmouth.

**Trenton, N. J.*—Scott Scannell, Secy. Bd. Mgrs., New Jersey State Hospital, writes that the following are the bids opened on July 20 for the erection of addition to the annex of the State Hospital (bidders all of Trenton): Jas. W. Lanning & Son, 314 N. Broad St., $227,850 (awarded contract); Lewis Lawton & Son, $239,000; Chas. Kafer, $228,950, and Thos. H. Prior & Son, $237,000.

Jersey City, N. J.—The Bd. of Chosen Freeholders has adopted a resolution deciding to erect a new almshouse at a cost not exceeding $190,000, and the appointment of C. Fred Long, 76 Montgomery St., to prepare the plans for same.

New Brighton, S. I., N. Y.—Bids will be received until Aug. 8 by Geo. Cromwell, Pres. Richmond Boro., New Brighton, for furnishing material for the mason, carpenter, structural steel and iron, heating and electric installation work for the erection of sheds, store-rooms, smithy, etc., in connection with Stables No. 1 and No. 2 for the Bureau of Street Cleaning.

New York, N. Y.—Bids will be received by the Dept. Pub. Charities (Jas. H. Tully, Comn.) until Aug. 4 for furnishing materials and erecting 7 emergency hospital pavilions on Blackwells Island; also, same date, for furnishing materials and erecting a coal storage building, Kings Co. Hospital, Boro. Brooklyn.

*The Geo. L. Walker Co., 156 5th Ave., has secured the contract to erect the glass court for the bird house in the New York Zoological Park in Bronx Park, Boro. of Bronx, at $24,199.

Plans have been filed for alterations to be made to the New York Hospital, at a cost of $20,000; Archts. Trowbridge & Livingston, 424 5th Ave.

Bids will be received until Aug. 15 by Fred H. Schroeder, Pres. Bd. Comrs. of Quarantine, 62 William St., for heating, plumbing, also construction of certain buildings at Upper Quarantine Station, Hoffmans Island, as advertised in The Engineering Record.

Albany, N. Y.—Bids will be received until Aug. 7 by the State Bd. of Armory Comrs. (Jas. McLeer, Brig. Gen., Chmn.,) for improvements to the Albany Armory.

Buffalo, N. Y.—Bids will be received until Aug. 28 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for construction (except heating apparatus, elevators, electric conduits and wiring) of the U. S. Marine Hospital at Buffalo.

*Esenwein & Johnson, archts., Ellicott Sq., it is stated, have awarded the following contracts for an addition to the Providence Retreat at Main St. and Humboldt Parkway, which is to cost about $300,000: Masonry, Chas. Berrick's Sons; carpentry, Neiderpreum & Gibbs Co.; iron work, H. C. Harrower; cut stone, Geo. W. Maltby & Son; fireproofing, Buffalo Expanded Metal Co.; roofing, Mackwirth Bros.; heating, Buffalo Forge Co.; electrical work, McCarthy Bros. & Ford.

Bids will be received until Aug. 1 by Alonzo G. Hinkley, Clk. Bd. Superv., for making alterations and additions to the Maternity Hospital at the County Hospital.

Utica, N. Y.—Bids will be received Aug. 4 by Henry W. Roberts, Co. Treas., for 520,000 Co. Court House bonds.

Cleveland, O.—It is stated that Lehman & Schmitt, Garfield Bldg., have notified the Co. Comrs. that plans for the county buildings will be ready about Aug. 10.

Hubbell & Benes, Citizens' Bldg., it is stated, have been selected by the Bd. Pub. Service to prepare plans for the new West Side Market.

**Mansfield, O.*—It is stated that contracts for the erection of the Carnegie Library have been awarded as follows: General construction to Saml. Mowery, of Mansfield, at $28,793; heating and plumbing to H. M. Bell, of Mansfield, at $1,950, and electric wiring to C. C. Runyan at $243.

**Zanesville, O.*—The contract to erect the Good Samaritan Hospital, it is stated, has been awarded to Williams Bros. at $63,617.

**Mangum, Okla. Ter.*—Floyd McNeill, Co. Clk., writes that Lee & Campbell, of Oklahoma City, have received the contract to erect the court house in Mangum (bids opened July 20), at $95,400.

Philadelphia, Pa.—It is stated that plans are being prepared for a veterinary hospital which is to be erected at the Univ. of Pennsylvania to replace the structure which was recently destroyed by fire.

Providence, R. I.—It is stated that improvements are to be made at the Rhode Island Hospital at a cost of $35,000.

Sumter, S. C.—Edwards & Walter, of Columbia, are preparing plans for a court house for Sumter County, to cost about $60,000. Bids will be called for early next year. W. H. Searle, Supervisor.

Pierre, S. D.—It is stated that bids are soon to be asked on the foundation work of the new State Capitol. Bell & Detwiler, of Minneapolis, Minn., are the architects.

La Porte, Tex.—It is stated that the citizens have voted in favor of issuing $500,000 bonds for the erection of a court house.

Richmond, Va.—The following are the 3 lowest bids recently received by the Superv. Archt., Treas. Dept., Washington, D. C., for steam heating apparatus in U. S. Court House and Post Office: Zellers & Co., Washington, D. C., $3,560; W. P. Longworth, Richmond, $4,150, and Smith Constr. Co., Richmond, $4,850.

Walla Walla, Wash.—The State Bd. of Control is said to be considering the enlargement of the State Penitentiary at Walla Walla, an appropriation of $20,000 having been made for the purpose. Proctor & Farrell, Archts., of Tacoma, may be able to give further information.

North Yakima, Wash.—Bebb & Mendell, of Seattle, it is stated, have been engaged to prepare plans for the public library, the cost to be about $15,000.

Toronto, Ont.—The City Council has passed an ordinance authorizing the issue of $200,000 for the purchase of land on which to erect the new provincial hospital. Ross Robertson, it is stated, has given $75,000 to the Hospital for Sick Children to be used to erect a nurses' home.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Guin Ala.—Bids will be received until Aug. 10 for erecting a brick bank here. W. E. Spinks, Archt., Guarantee Bldg., Birmingham.

**Los Angeles, Cal.*—Murphy & Crook are stated to have secured the contract for erecting the Hollenbeck Masonic Temple on 1st and State Sts., for $17,295.

Denver, Colo.—H. A. Pence, it is reported, has purchased a site at Bway. and 20th Ave. on which he will erect a $40,000 business building.

*It is reported that A. R. Whitney, of New York City, has received the contract to erect a fireproof building at 16th and Champa Sts. for Symes Co., at a cost of $325,000.

Washington, D. C.—A building permit has been granted to Thos. F. Walsh to erect a 7-story office building at 801 G St. N. W., estimated to cost $195,000. Townsend, Steinle & Haskell, of New York City, are the architects.

Boise, Idaho.—The Artesian Hot & Cold Water Co., it is stated, has decided to erect a $50,000 hotel.

Chicago, Ill.—Joseph Vehon, President of the Royal Tailors, it is stated intends erecting a mercantile and manufacturing building for the company at 5th Ave. and Polk St. It will be a 7-story, fireproof structure, 115x102 ft. and cost $200,000.

The Salvation Army has obtained title to the property at 551 to 555 West Madison St. and is planning to put up a building to cost $70,000.

The Woodlawn Masonic Temple Assoc. has engaged David Robertson, 184 La Salle St., to prepare plans for the fraternity building to be erected at 63d St. and Lexington Ave. The structure will be 4 stories high, 60x95 ft., of pressed brick and stone and cost $50,000.

**Moline, Ill.*—Geo. H. Johnson, of St. Louis, Mo., it is stated, has secured the contract to erect the Moline Opera house, at $38,000.

New Augusta, Ind.—It is reported that bids will be received until Aug. 11 by the Bd. Trus. (Wm. B. McDonald, Chmn.) for erecting a Masonic temple of hollow concrete bricks.

Evansville, Ind.—Parsons & Scoville, wholesale grocers, it is stated, will erect an $85,000 building at Main and Amity Sts. to replace the structure which was destroyed by fire.

**Clarion, Ia.*—P. J. McCavick, it is stated, has secured the contract to erect the depot here for the Great Western R. R., at a cost of about $15,000.

Rockwell City, Ia.—The American Life Insurance Co., of Des Moines, it is reported, intends erecting a $20,000 hotel here.

**Sioux City, Ia.*—J. J. Keefe, 306 Pierce St., is stated to have secured the contract for erecting the West Hotel on 3d and Nebraska Sts. for about $100,000.

F. M. Pelletier, it is reported, has purchased a site on which he intends erecting a business building at a cost of about $100,000.

Des Moines, Ia.—Plans are being prepared for a $75,000 building which is to be erected at 10th and Cherry Sts. by the National Biscuit Co. D. F. Givens, Mgr.

Lexington, Ky.—J. Rogers Barr, of Lexington, Gen. Mgr. of the Lexington & Eastern R. R., it is stated, has purchased a site on E. Main St. on which a union depot is to be erected for the Louisville & Nashville, the Chesapeake & Ohio and the Lexington & Eastern railroads. Plans are to be prepared at once, and the cost is to be at least $30,000.

Shreveport, La.—Bids will be received until Aug. 7 by the Bldg. Com. (Andrew Querbes, Pres.), for furnishing material and erecting a 3-story brick, terra cotta and steel-framed building for the B. P. O. Elks, No. 122.

New Iberia, La.—It is reported that Octave Renoudet and L. E. Marion are organizing a company to erect a hotel at a cost of $50,000.

New Orleans, La.—The Crescent City Jockey Club, it is reported, will spend $100,000 in improvements. Address secretary.

The Pythians have decided to erect a castle hall here, to cost about $150,000.

A. Monteleone, owner of the Commercial Hotel, it is stated, intends erecting a 10-story annex.

Opelousas, La.—The Bldg. Com. of the Opelousas Improv. & Development Co., it is stated, has accepted the plans of Honold & Gauthier, of Abbeville, for the hotel which is to be erected, at a cost of about $50,000. It is stated that bids for the construction will soon be asked.

**Springfield, Mass.*—Local press reports state that the Springfield Institution for Savings has awarded the contract to prepare plans and erect a bank building to Hoggson Bros., 7 E. 44th St., New York, N. Y., the cost to be about $150,000.

Kalamazoo, Mich.—It is reported that Miss Mary O'Brien intends erecting a 5-story business building at 113 S. Burdick St. at a cost of $23,000.

Minneapolis, Minn.—S. J. Bowler, Bank of Commerce Bldg., is preparing plans for remodeling the S. T. McKnight 5-story building at 240-242 1st Ave. S into a modern hotel and restaurant, to be conducted by Jacob Barge and P. Zahnen. Cost, $20,000.

**Vicksburg, Miss.*—The contract to erect the 8-story fireproof, steel and brick, bank and office building for the First Natl. Bank, it is stated, has been awarded to F. J. McGraw, of Vicksburg, at about $180,335.

**Greenville, Miss.*—It is stated that Chester Pearce, of Greenville, has received the contract to erect a 5-story annex to the Hotel Cowan, at a cost of $25,000.

**Springfield, Mo.*—Perry Buchanan, 310 W. Olive St., has secured the contract for erecting a 3-story brick mercantile building 100x117 ft. for $22,787. Owners, Stewart, Schmook & Culler.

John J. Dean, it is reported, is preparing to erect a $200,000 hotel here.

Kansas City, Mo.—Howe, Hoit & Cutler are stated to have prepared plans for a warehouse to be erected at Walnut and 16th Sts., for Emery Bird-Thayer Co., to cost $70,000.

Michael C. Simon, it is reported, will erect a 7-story business building at 11th and Walnut Sts., to cost $100,000.

**St. Louis, Mo.*—A building permit has been granted to the Emporium Realty Co. to erect an 8-story brick fireproof department store of the Grand Leader at 6th St. and Washington Ave., the cost to be about $800,000. The Westlake Constr. Co., 510 Pine St., is the builder; Mauran, Russell & Garden, 721 Oliver St., are the architects.

**Butte, Mont.*—G. S. Johnson & Son, of Chicago, Ill., it is stated, have secured the contract to erect a depot here for the Northern Pacific, the cost to be about $100,000.

**Lincoln, Neb.*—Wm. Worthman, of Seward, it is stated, has secured the contract to rebuild the Burlington depot here at a cost of about $75,000.

Omaha, Neb.—It is stated that Paxton & Gallagher intend erecting an 8-story building on the site of their present building, the cost to be about $200,000.

A building permit has been issued for the erection of a 7-story store building, which is to be erected by J. L. Brandeis & Sons at 16th and Douglas Sts., at a cost of about $650,000.

**Trenton, N. J.*—The contract to renovate the Hill store, at 11 N. Broad St., it is stated, has been secured by Patrick J. O'Neill, of Yardley, at about $23,000.

Oswego, N. Y.—The New York, Ontario & Western R. R. Co. (T. P. Fowler, Pres., 56 Beaver St., New York), is reported to have under consideration the erection of a freight house at Oswego.

**Buffalo, N. Y.*—Metz Bros., 324 Landon St., it is reported, have secured the contract to erect the Chamber of Commerce Bldg. at $299,000.

The members of the Saturn Club, it is stated, are planning to erect an addition to the club house at a cost of about $30,000.

**Spencer, N. C.*—The Southern Ry. Co., it is stated, has awarded the contract to erect the Y. M. C. A. bldg. to W. S. Grandy & Son, of Greenville, S. C., at about $20,000.

Fargo, N. D.—Chas. J. Allen, Gen. Secy., Y. M. C. A., writes that all bids opened July 15 for the erection of a Y. M. C. A. building were rejected as being too high, and new bids will be received Aug. 1.

Canton, O.—Archt. Bostick, of Massillon, has prepared plans for a 3-story, brick and stone flat to be erected at Cleveland Ave. and W. 9th St., to cost $16,000. Chas. W. Koons, owner, Canton.

Cleveland, O.—A site has been secured on Euclid Ave. and Oak Place on which it is proposed erecting the $1,000,000 hippodrome. Plans are to be prepared at once.

**Youngstown, O.*—Niedermier & Restle, of Youngs-

Items marked thus give the names of parties awarded contracts.

town, and the Harper Lumber Co., of Meadville, Pa., it is stated, have secured the contracts for the erection of the M. A. Norris Bldg. on Federal St., the total cost to be about $20,000.

*_Cincinnati, O._—It is stated that the contract to erect the Pike Hotel has been awarded to Harig & Co., 327 Livingston St., at $735,000.

Oklahoma, Okla. Ter.—See "Railroads."

Erie, Pa.—See "Railroads."

*_Allegheny, Pa._—Roydhouse, Arey & Co., of Philadelphia, it is reported, have secured the contract for erecting a passenger station here for the Pennsylvania R. R., at a cost of about $200,000; also the contract to erect a passenger station in Wilmington, Del., for the same road, at a cost of about $200,000. Both buildings are to be of brick and stone and will be equipped with up-to-date lighting and heating systems, etc.

McKeesport, Pa.—It is reported that John P. Harris has purchased a site on which he proposes to erect a theater at a cost of $40,000.

York, Pa.—It is reported that the York Hotel is to be improved at a cost of $75,000. The York Hotel Co., owners.

Pittsburg, Pa.—F. J. Osterling, _Times_ Bldg., it is stated, is preparing plans for a 6-story furniture warehouse which is to be erected by Vincent, Scott & Co. at Penn Ave. and Beatty St., East End, at a cost of $125,000.

Titusville, Pa.—L. K. Hyde is reported interested in the forming of a company for the purpose of erecting a club house to cost about $18,000.

Knoxville, Tenn.—It is stated that improvements are to be made to the Henson Bldg. at a cost of $25,000.

*_Houston, Tex._—J. D. Williams, of Houston, it is stated, has secured the contract to erect the opera house at about $30,000.

Salt Lake City, Utah.—O. J. Salisbury, it is reported, will erect a 3-story business building, at an estimated cost of $100,000.

Lynchburg, Va.—The Bd. of Directors of the Y. M. C. A., it is stated, is considering plans for erection of a new home for the association.

*_Seattle, Wash._—Remington & Sherman, of New York City, it is stated, have secured the contract for the vault work in the new building for the American Savings Bank & Trust Co., on 2d Ave. and Madison St., the cost to be about $20,000.

John Davis & Co., it is stated, have purchased a site on the water front in N. Seattle, on which it is proposed erecting a natatorium, at a cost of $50,000.

Building permits have been issued to the American Savings Bank & Trust Co. for the construction of a 12-story, reinforced concrete building, 60x108 ft., estimated cost $300,000, and to Thos. Burke for the construction of a 12-story, reinforced concrete building, 60x108 ft., to cost $250,000. A. Warren Gould is archt. for both buildings.

*_Menasha, Wis._—Peter Andrews, of Fond du Lac, it is reported, has secured the contract to erect a hotel here at about $30,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—Plans have been accepted, according to reports, for a $15,000 edifice which is to be erected by the members of the First Presbyterian Church. Rev. C. R. Gilmore, pastor.

Hot Springs, Ark.—Jacob Kempner, it is reported, is preparing to erect a 3-story flat estimated to cost $40,000.

Denver, Col.—Philip Griffith, it is reported, has purchased a site on B'way, near 19th St., on which he intends erecting an apartment house, at a cost of about $30,000.

*_Colorado Springs, Colo._—Dannevik & Currie, 21 N. Nevada St., it is reported, have secured the general contract on a residence which F. M. Taylor intends erecting at a cost of $22,000.

R. F. Davis, it is stated, intends erecting a residence at a cost of $30,000.

Athens, Ga.—It is reported that the members of the Presbyterian Church have accepted plans for remodeling the edifice at a cost of $20,000. Address pastor.

Savannah, Ga.—Percy Sugden, Merchants' Natl. Bank Bldg., has prepared plans for a residence for M. J. Kavanaugh; estimated cost, $12,000.

Boise, Idaho.—J. E. Tourtellotte & Co., of Boise, it is reported, are preparing plans for an $85,000 building for the St. John's Cathedral.

Chicago, Ill.—S. Milton Eichberg, 160 Washington St., it is stated, has prepared plans for a synagogue, 3 stories high, which is to be erected by the First Hungarian Jewish congregation, Agudat Achim, on Marshfield Ave. and W. Polk St., at a cost of about $50,000. Adolph Frisch, Chm. Bldg. Com.

The St. Ambrose R. C. Church has accepted plans for erecting a $75,000 church, to erected at Ellis Ave. and 47th St. Address pastor.

Andrew Sandegren, 119 Monroe St., has been selected to prepare plans for a three-story apartment house, 100x210 ft., to be erected by August Wallentin at 48th St. and Drexel Boule. at a cost of about $100,000.

L. Mart Mitchell, 145 La Salle St., is preparing plans for a 3-story apartment building, which is to be erected at Wabash Ave. and 60th St., for Benjamin F. George; approximate cost, $100,000.

A 3-story apartment, 120x160 ft. is to be built in the Woodlawn district for Sellon & Harley at a cost of $100,000.

Schock & Swanson, 172 Washington St., are preparing plans for a 3-story apartment building to be built on Logan Square at a cost of $100,000.

Dr. John A. McGill has purchased a site at Indiana Ave. and 20th St., and will erect a 5-story fireproof apartment building, to cost about $75,000.

Benj. F. George will erect a 3-story flat at 66th St. and Drexel Boule., to cost $75,000.

Evanston, Ill.—Thos. Templeton, it is stated, will erect a 2-story residence here, to cost about $25,000.

Logansport, Ind.—The members of the 9th St. Christian Church, it is stated, intend erecting a new edifice at a cost of $25,000. Rev. J. H. Craig, Pastor.

*_Huntington, Ind._—It is stated that Blair & Co., of Warsaw, Ind., have secured the contract to build the new Christian Church in this city for $22,780.

Clinton, Ia.—It is reported that bids will be received until Aug. 5 for erecting a R. C. Church. Address Rev. J. T. Noonan.

Storm Lake, Ia.—J. G. Ralston, of Waterloo, Ia., it is reported, is preparing plans for a $20,000 edifice to be erected for the members of the Methodist Church.

*_St. Paul, Minn._—A permit has been issued for a 2-story brick flat to be erected on University Ave. and Kent St. to cost $16,000. Builder, the St. Paul Bldg. Co., 209 W. 5th St.

Morris, Minn.—The members of the Assumption R. C. Church, it is reported, intend rebuilding the church, which was destroyed by fire.

Elizabeth, N. J.—It is stated that a $40,000 edifice is to be built on 3d St. by the congregation of the Polish Catholic Church.

*_Riverton, N. J._—Metzger & Wells, it is stated, have secured the contract to make alterations and additions to a residence here for N. Myers Fitler at a cost of $18,000. G. W. & W. D. Hewitt, Bullitt Bldg., are the architects.

New York, N. Y.—Plans have been filed for alterations to be made to H. H. Flagler's residence at 32 Park Ave. at a cost of $50,000; Little & O'Connor, Archts., 5 W. 31st St.; also for a brick and stone church rectory, convent, school and vestry buildings to be erected at 414 W. 34th St., by the Pennsylvania, New York & Long Island R. R. Co., for St. Michael's Parish; total cost, $500,000 Archts., N. Le Brun & Sons, 1 Madison Ave.

Hempstead, L. I., N. Y.—St. George's Episcopal Church, it is stated, is to be remodeled at a cost of $15,000. Rev. J. K. Cooke, rector.

Winston-Salem, N. C.—It is stated that plans have been adopted for the R. E. Caldwell memorial building which is to be erected as an annex to the First Presbyterian Church, the cost to be about $15,000.

Grand Forks, N. D.—It is reported that Dinner Bros. will erect a $20,000 apartment house.

*_Merion, Pa._—A. Whitehead, of Philadelphia, it is stated, has secured the contract to erect a residence here for Frank Thompson at a cost of $20,000.

*_Haverford, Pa._—Geo. W. Deaves, of Llanerch, it is stated, has secured the contract to erect a residence and stable for C. S. Taylor at Haverford, the cost to be about $50,000. H. L. Reinhold, Jr., of Philadelphia, is the architect.

*_Norristown, Pa._—Richd. Kerns, of Bridgeport, it is stated, has secured the contract to erect the Aged Women's Home at $20,000.

*_Derry Church, Pa._—Greiner Bros., of Stroudsburg, it is reported, have secured the contract to erect for M. S. Hershey a residence at Derry Church, to cost about $60,000.

Philadelphia, Pa.—A building permit has been granted to W. J. Gruhler, 77 Herman St., Germantown, to erect a 3-story, 24x44-ft. addition to the residence of Randall Morgan at Chestnut Hill, the cost to be about $20,000.

Lexington, Tenn.—It is reported that bids will be received until August 10 by E. J. Timberley, Citizens' Bank, for erecting a church.

Memphis, Tenn.—It is stated that a 6-story flat is to be erected by Geo. C. Bennett on Madison St., opposite Forrest Park, at a cost of $200,000. Chighizola, Hanker & Cairns, Scimitar Bldg., are the architects.

Nashville, Tenn.—It is reported that the congregation of McLemore Ave. Presbyterian Church is contemplating the erection of a new edifice at a cost of $35,000. Rev. J. H. Morrison, Pastor.

Texarkana, Tex.—It is reported that the Beech City Baptist Church will erect a $35,000 edifice. Address pastor.

*_Racine, Wis._—Jas. Corse, it is reported, has received the contract to erect a $27,000 apartment house at College Ave. and 7th St.

SCHOOLS.

Notes Arranged Alphabetically by States.

Eastlake, Ala.—It is stated that at the Alabama State Baptist convention which is being held in Sheffield it was decided to accept the offer of John D. Rockefeller to give $25,000 toward a science hall for Howard College, at Eastlake.

New Haven, Conn.—The Legislature has passed a bill authorizing city of New Haven to borrow $50,000 to build a new schoolhouse in Webster Dist.

Ansonia, Conn.—A bill has passed the Legislature authorizing city of Ansonia to issue $70,000 school bonds.

*_Hartford, Conn._—Wm. F. O'Neill, it is stated, has secured the contract to erect a convent house and seminary for the Sisters of St. Joseph on Framington Ave., at a cost of about $300,000. John J. Dwyer, 78 Turnbull St., is the architect.

Dublin, Ga.—It is reported that bids will be received until Aug. 1 for erecting an 8-room school.

*_St. Anne, Ill._—The Bd. of Educ., it is stated, has awarded the contract to erect a school here to F. L. Krauel, of Danville, at $50,000.

Benton, Ill.—Plans have been completed, according to reports, for a $20,000 school.

*_Lafayette, Ind._—The citizens have voted in favor of issuing $22,000 bonds for the erection of a high school on the West Side, and the contract for its erection, it is stated, has been awarded to H. C. Sense, at $20,683.

St. Charles, Ill.—Bids will be received until Aug. 7 by the Bd. Trus. (N. W. McLain, Secy.), St. Charles' School for Boys, for erecting a barn, alterations to the power house, and for an ice house for said school.

Fairfield, Ia.—It is stated that Andrew Carnegie has given $20,000 to Parsons College to erect a library.

Scottsville, Ky.—Bids will be received until Aug. 1 by the Bldg. Com. (A. S. Gardner, Chmn.) for erecting a 2-story brick college here. Jas. H. Yeamans, Archt., Nashville, Tenn.

Donaldsonville, La.—It is reported that bids will be received until Aug. 23 by the Mayor for $56,000 bonds, $31,000 being for street and sidewalk improvements and for enlarging the water-works and $25,000 toward a $50,000 high school.

Magnolia, La.—The Mayor and Bd. of Aldermen, it is stated, intend issuing $15,000 bonds, the proceeds to be used to erect a brick school.

*_Arcadia, La._—R. K. Black, of Ruston, it is stated, has secured the contract to erect a school here at $14,469.

Maynard, Mass.—Bids will be received until Aug. 8 by the Bd. Selectmen (A. J. Coughlan, Secy. Com.) for erecting a brick school. C. J. Bateman, Archt., 12 Pearl St., Boston.

Havre de Grace, Md.—Bids will be received until Aug. 2 by the Bd. Co. School Comrs. at Belair (Chas. T. Wright, Secy.) for erecting an annex to the Havre de Grace High School.

Everett, Mass.—P. H. Jackson & Son, of Brockton, are reported to have submitted the lowest bid for erecting the Everett high school for $62,031. Architects, Loring & Phipps, 53 State St., Boston.

Somerville, Mass.—Walter T. Littlefield has prepared plans for an addition and improvements to be made to the High School. Appropriation, $40,000.

*_Pontiac, Mich._—The S. B. Cole Co., of Tawas City, it is stated, has secured the contract to erect the 5th Ward school at $29,330.

Ann Arbor, Mich.—Camfield & Co., of Findlay, O., it is stated, submitted the lowest bid for erecting the high school at $250,780.

*_Minneapolis, Minn._—The contract for the erection of the bacteriological building at the State Univ., it is stated, has been awarded to Trainor Bros., Boston Blk., at about $100,000.

Laurel, Miss.—Plans and specifications will be received until Aug. 15 by the Mayor and Bd. of Aldermen for a brick high school, 2 story and basement, to cost about $20,000, including plumbing and heating. W. F. Daly, City Clk.

Oakville, Mo.—Bids will be received until Aug. 12 by the Bd. of Directors (Fred. J. Wermeier, Secy.), for erecting a school in Dist. No. 1.

Hackensack, N. J.—It is stated that bids will be received until Aug. 10 for erecting extensions to the 1st St. and State St. schools. S. T. Demarest, Dist. Clk.

Englewood, N. J.—Bids will be received by the Bd. of Educ. until August 8 for the construction of a school, as advertised in the Engineering Record.

Santa Fe, N. M.—Bids will be received until August 22 by the Comr. of Indian Affairs, Dept. of the Interior, Washington, D. C., for furnishing material and erecting a dormitory and a lavatory both of brick with steam heat and electric light and an extension of the sewer system at Santa Fe School. C. F. Larrabee, Acting Comr.

*_Shiprock, N. M._—It is reported that Geo. E. Hopper, of Arkansas City, Kan., has secured the contract to erect several buildings at the Shiprock U. S. Training School, at a total cost of $68,250.

*_New York, N. Y._—The following are the bids opened July 24 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for sanitary work and gas fitting of new public school 38, Boro. of Manhattan: Dowdeswell Bros., 399 Bridge St., Brooklyn, $30,342 (awarded contract); Jas. Fay's Son, $34,860; Jere. J. Deady, $35,400; Frank J. Fee, $32,092.

Carthage, N. Y.—Plans have been completed by D. D. Kieff, of Watertown, for the 3-story brick and limestone high school which it is proposed erecting in the rear of the present high school at a cost of $28,000.

Uniondale, N. Y.—It is reported that the School Bd. intends erecting a $15,000 school.

Geneseo, N. Y.—Bids will be received until Aug. 4 by Hon. Andrew S. Draper, Comr. of Educ., Capitol, for new boilers and changing the heating system at the State Normal School, Geneseo.

Binghamton, N. Y.—The Carrington-Ford Co., it is stated, submitted the lowest bid for erecting the Robinson St. School at $54,950.

Durham, N. C.—Bids will be received about Aug. 5 for the erection of a high school, to cost about $33,000. Architects, Wheeler, Runge & Dickey, of Charlotte.

La Moure, N. D.—Bids will be received until Aug. 25 by A. G. Gruden, Clk. La Moure School Dist., First Natl. Bank, for plumbing and heating in the school. W. C. Albrant, Archt., Fargo, N. D.

Columbus, O.—The erection of a gymnasium at the Ohio State Univ., at a cost of about $60,000, is reported under consideration.

Bids will be received until Aug. 12 by D. Riebel & Sons, Archts., New 1st Natl. Bank Bldg., for furnishing material and erecting a combination school and chapel building for the Church of the Holy Rosary. Rev. F. W. Howard, pastor.

*_Marion, O._—W. C. Stafford, of Marion, it is reported, has received the contract to erect a school at $20,525.

Youngstown, O.—Bids will be received until Aug. 16 by W. N. Ashbaugh, Clk. Bd. Educ., for furnishing material and erecting a 10-room brick and stone school on Myrtle Ave.

Trafford City, Pa.—It is stated that the citizens have voted in favor of erecting a $15,000 school.

Carrick, Pa.—Bids will be received until August 7 by Frank M. Sankey, Secy. School Bd., for erecting a school. T. W. Boyd & Co., Archts., House Bldg., Pittsburg, Pa.

Sioux Falls, S. D.—The citizens have voted in favor of issuing $75,000 bonds for the erection of a high school.

Dallas, Tex.—It is stated that about 15 acres on Argyle Ave., in Oak Lawn, have been purchased by the Fathers of St. Vincent de Paul, on which they purpose erecting a college, the buildings alone to cost about $150,000. Rt.

***_Items marked thus give the names of parties awarded contracts._**

Rev. E. J. Dunne, Bishop of the R. C. Diocese of Dallas, may be able to give further information.

Richfield, Utah.—The School Directors, it is reported, are considering the erection of a school at a cost of $20,000.

Everett, Wash.—The United Norwegian Lutheran Church, it is stated, intends erecting a college here at a cost of about $20,000.

Waukesha, Wis.—Bids will be received until Aug. 2 by the State Bd. Control, Madison, for furnishing materials and constructing a tunnel at the Industrial School for Boys at Waukesha; Lew F. Porter, Archt., Ellsworth Blk., Madison.

Hayward Wis.—Bids will be received until August 17 by the Dept. of the Interior, Comr. of Indian Affairs, Washington, D. C. (C. F. Larrabee, Acting Comr.), for furnishing material and erecting a brick addition to warehouse at the Hayward School. W. A. Light, Supt., Hayward.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

New York, N. Y.—The following are the bids opened July 21 by the Dept. of Street Cleaning for furnishing all material and labor required for removing snow and ice in Manhattan Boro. Bids were submitted according to districts, price given per cu. yd.: (*a*) N. Y. Contracting & Trucking Co., 215 W. 33d St.; (*b*) Chas. T. McCabe, 181st St. and Jerome Ave.; (*c*) Thos. Crimmins Contr. Co., 69th St. and Ave. A.; (*d*) Uvalde Asphalt Paving Co., 1 Bway; (*e*) Wm. Bradley, 86th St. and Bway:

	a	*b*	*c*	*d*	*e*
District 1............	$0.23	$0.22	$0.22	$0.20	$0.17
District 2............	.22	.21	.21	.19½	.17
District 3............	.25	..	.23	.19½	.17
District 4............	.25	..	.23	.18½	.17
District 5............	.22	..	.21	.18	.17
District 6............	.22	..	.21	.18	.15
District 7............	.20	..	.17	.17	.17
District 8............	.23	..	.19	.17	.16
District 9............	.20	..	.17	.16	.12
District 10............	.21	..	.17	.16	.13
District 11............	.21	..	.18	.16	.13

New York, N. Y.—Bids will be received until Aug. 7 by F. M. Gibson, Deputy and Acting Comr. of Street Cleaning, for furnishing all the labor and material required for removing snow and ice in the 7th Dist., Boro. Manhattan.

The following are the bids opened July 26 by John McG. Woodbury, Comr. Street Cleaning, for furnishing all labor and materials required for the removal of snow and ice in Bronx Boro. (price given per cu. yd.): Schuanfer & Dunigan, 714 E. 149th St., 10 cts.; Lynch Contr. Co., 435 W. 21st St., 8½ cts.; Wm. Bradley, 86th St. and Bway., 14 cts.; Jos. Shea Contr. Co., 27 Pine St., 10 cts.; Thos. Crimmins Contr. Co., 444 E. 69th St., 17 cts., and Chas. F. McCabe & Co., 181st St. and Jerome Ave., 12½ cts.

Steubenville, O.—The Council is reported to have passed an ordinance providing for an issue of $15,000 bonds for the construction of a garbage crematory.

Panama.—The following are the bids opened on July 24 by the Isthmian Canal Comn., Washington, D. C., for furnishing a destructor at Bas Obispo, Isthmus of Panama; Morris Bulger Destructor Co., New Yorg, N. Y.; $1,900; National Equipment Co., St. Louis, Mo., $5,500; Louis McKetchin, Chicago, Ill., $1,790, and Dixon Garbage Crematory Co., Toledo, O., $2,245.

Washington, Pa.—O. K. Taylor, Jr., City Engr., would like information regarding a garbage-disposal system for a city of 25,000 population, as advertised in The Engineering Record.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

B. A. James Mfg. Co., Clarkesville, Tenn., is building a 105x45-ft., 4-story knitting mill. A number of knitting machines and a 35-h.p. engine will be installed.

Boaz (Ala.) Fertilizer Co. has purchased the plant of the Boaz Chemical Co. and will increase the capacity of the plant and add a 60x100-ft. storage warehouse.

Farmers' Elevator Co., Honeyford, N. D., will shortly build a 40,000-bushel elevator. The elevator will be equipped with modern machinery and will be operated by a 15-h.p. gasoline engine.

Scranton (Pa.) Steam Pump Co. will rebuild its foundry, recently destroyed by fire. The new building will be of brick and steel construction, 400x60 ft., and will be equipped with electric cranes, air molding machines and other modern foundry appliances.

J. E. Fox Saw Works, Seattle, Wash., has purchased a site for a new plant, which will consist of main building, 120x40 ft., 2 stories high, and 1- story "L", 40 ft. square. Machinery from old plant will be employed, with the probable addition of a drop forge hammer.

Diamond Iron Wks., Minneapolis, Minn., is building a 285x165-ft. addition to its plant. The new building will be equipped with electric cranes and other modern machinery.

The Friedman-Blau-Farber Co., Cleveland, O., are preparing plans for two additional buildings, one 120x200 ft., 4 stories, and the other 55x147 ft., part 1 story and part 2 stories. Two boilers of 150 hp. each and two generators of 40 kw. each will be installed.

Peters Packing Co., McKeesport, Pa., will erect a fireproof cold storage building, measuring 45x80 ft.

Henry Orme's Sons will shortly erect at Columbia Heights, Minneapolis, Minn., a foundry building measuring 150x50 ft. A 30-h.p. motor will be required.

Nebraska Flour Export Co., Lincoln, Neb., will shortly begin the erection of a 40x68-ft. blending plant. About 20 h.p. will be required.

The E. G. Wallof Machine Wks., Minneapolis, Minn., is erecting a 2-story, brick, factory building, measuring 33x110 ft. A 25-h.p. gas engine will be installed.

Humphrey Mfg. Co., Towanda, Pa., is having plans prepared for a plant consisting of machine shop, foundry, pattern shop and pattern storage, and boiler house, to be erected at Elkins, W. Va.

The Keller Mfg. Co., Sauk Center, Minn., is contemplating the erection of a 150-h.p. power plant at Minneapolis. Gas power will be considered.

Utica (N. Y.) Steam & Mohawk Valley Cotton Mills are contemplating making additions to their plant which will increase its capacity about 10 per cent. A 302x120 ft., 5-story building of mill construction will be added, together with about 1,500 addition horse power.

Puget Sound Metal Works, Tacoma, Wash., will shortly add a 50x60-ft., 1-story building to its present plant.

J. B. Voss, Davenport, Ia., is contemplating the erection in the near future of a flour and saw mill at Mt. Ida, Ark.

Eureka Fence Mfg. Co., Richmond, Ind., has purchased the Schneider carriage plant and will make extensive additions and alterations. This company is in the market for electric motors.

The International Bavarian Brewing Co., St. Paul, Minn., will shortly erect a brewing plant to cost about $200,000, according to local newspaper reports.

Cleveland (O.) Hosiery Mills, recently incorporated, will shortly begin the erection of a 2-story, 60x200-ft. building.

Cleveland (O.) Woolen Mills is replacing portion of its plant recently burned with a 4-story brick building, 60x300 ft. New machinery will be installed.

John Faulkner & Son, Bay City, Mich., are erecting a 6-story brick and steel building, measuring 350x130 ft., for the manufacture of chemicals. This company will require several compressors, pumps of various sizes, castings, steel tanks and six 250-hp. boilers.

Adams & Elting Co., Chicago, Ill., will shortly begin the erection of a manufacturing plant, to cost about $125,000, according to local newspaper reports.

Main Belting Co., Philadelphia, Pa., will erect a 3-story factory building, measuring 45x105 ft., according to local newspaper reports.

Chambersburg (Pa.) Hosiery Co. will erect a large addition to its plant, according to local newspaper reports.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Fresno, Cal.*—The Supervisors are reported to have awarded to the Pacific Constr. Co., of San Francisco, the contract to beautify the Court House park and grounds, for about $70,000.

San Francisco, Cal.—Bids will be received until Aug. 29 by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing forges, separator, drop hammer, etc., at the navy yard, Mare Island, Cal.

Sacramento, Cal.—Bids will be received until Aug. 5 by the Auditing Bd. of the Comn. of Pub. Wks. (Thos. B. Hall, Secy.) for repair work on Butte Slough Weir, situated about half mile east of Sacramento. The work consists of approximately 12,000 cu. yd. of earthwork, 75 standard piles 35 to 40 ft. in length (land driving), 55,000 ft. of Wakefield sheet piling (land driving), 1,250 cu. yd. brush fascines and 300 tons of rock.

Wilmington, Del.—Bids will be received until Aug. 21 by Capt. C. A. F. Flagler, Corps Engrs., U. S. A., for dredging Appoquinimink River, Del.

Washington, D. C.—Bids will be received until Aug. 15 by the Bureau of Supplies and Accounts, Navy Dept., Washington, for furnishing at the Naval Station, Guantanamo Bay, Cuba, a quantity of Portland cement, expanded metal, etc.; also on same date for furnishing at the Navy Yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of supplies, including wire cable, drills, locks, iron, brass, water meters, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Key West, Fla.—Bids will be received until Aug. 8 by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the naval station, Key West, a quantity of Portland cement, granolithic and iron or steel fence. H. T. B. Harris, Paymaster Gen., U. S. N.

Augusta, Ga.—It is reported that about Sept. 1 the Lombard Iron Wks. & Supply Co., of Augusta, will award a contract for a pneumatic or electric crane for foundry department; to have 46-ft. span centre to centre of rail, and on the carriage of a 5 and a 15 or 20-ton hoist, with operator's carriage, etc.

Chicago, Ill.—Local press reports state that a syndicate, including Jas. K. Sebree, proprietor of the Saratoga Hotel, and Alanson Follansbee, a banker, 199 La Salle St., propose constructing a new amusement park on the lake shore, to extend from Jackson Park to 71st St. In addition to the amusements there is to be a $1,000,000 hotel on the lake shore, which, together with the amusement projects and landscape gardening and scenic effects planned, will represent an investment of approximately $3,000,000. D. H. Burnham & Co., Railway Exchange Bldg., are to prepare all the building and landscape plans.

Bids will be received until Aug. 19 by Dept. Pub. Wks. (J. M. Patterson, Comr.) for boring to be made in Lake Michigan on a line extending from the 68th St. crib to the foot of 73d St.

Plymouth, Ind.—It is stated that bids will be received until Aug. 7 by John C. Butler, Constr. Comr., for constructing Wolf Creek ditch, 3,560 ft. long, average depth 6½ ft.

Valparaiso, Ind.—Bids will be received until Aug. 11 at the law office of Frank B. Parks, Valparaiso, for constructing Hutton Ditch, which is 14 miles long, an average width of 22 ft., depth 7 ft., running through prairie land; no timber.

Bossier, La.—Bids will be received until August 3 by the Bd. Comrs. of the Bossier Levee Dist. at Bossier (W. T. Colquitt, Pres.), for levee work in the parish of Bossier, as follows: Magenta, approximately 70,000 cu. yds., and Gold Dust, approximately 26,000 cu. yds.

New Orleans, La.—Bids will be received until Aug. 1 by the Bd. Comrs., Lafourche Basin Levee Dist., Rm. 401, Cotton Exchange Bldg. (J. Maurin, Pres.) for enlarging the Star Levee, Parish of Plaquemines.

Boston, Mass.—The following are the bids opened on July 22 by Col. W. S. Stanton, Corps Engrs., U. S. A., for dredging in Weymouth Fore River: (*a*) price per cu. yd. for dredging; (*b*) price per removing each bowlder weighing 3 tons or more ($52,000 will be expended for this work): Eastern Dredging Co., 247 Atlantic Ave., Boston, *a* 23¾ cts., *b* $6; J. S. Packard Dredging Co., 425 Angell St., Providence, R. I., *a* 25 cts., *b* $10; R. G. Packard Co., 130 Pearl St., New York, N. Y., *a* 50 cts., *b* $20.

Boston, Mass.—It is stated that bids will be received until Aug. 1 by the Bd. Harbor and Land Comrs. for about 20.250 cu. yd. dredging.

Detroit, Mich.—Lieut.-Col. C. E. L. B. Davis, Engr. U. S. A., Detroit, in a recent report is stated to have recommended an appropriation of $3,390,000 to be expended on St Mary's Falls Canal at the Soo, and $1,000,000 for completing the Hay Lake and Neebish Channels.

New York, N. Y.—The following are the bids opened on July 20 by the Comrs. of Parks for furnishing material and completing the grading, walls, steps, and coping, etc., around Baird Court, to the New York Zoological Park, in Bronx Park: Culgin-Pace Contr. Co., $125,724; Bart Dunn, $77,522; Gallo & Pittelli, $85,000; Guidone & Galardi, 114 E. 23d St., $71,700; M. J. Leahy, $83,000; John V. Schaefer, Jr., & Co., 9 E. 59th St., $67,000, and Geo. L. Walker Co., $78,796.

Bids were opened same time and place for 2,000 cu. yds. broken stone of trap rock and 3,500 cu. yds. screenings of trap rock: Clinton Point Stone Co., $1.68½ per cu. yd.; total, $9,267; Jacob E. Conkin, $1.77; total, $9,735.

**Buffalo, N. Y.*—C. W. Handy, of Cleveland, O., is stated to have secured the contract for constructing the stone superstructure sea slope and stone riprap on South Harbor section of Buffalo breakwater for about $93,160 (bids opened July 8 by Col. Henry M. Adams, Corps Engrs., U. S. A.)

Troy, N. Y.—Bids will be received until Aug. 1 by Wm. H. Gearin, Compt., for $34,055 public improvement bonds.

Panama.—Bids will be received until Aug. 3 by D. W. Ross, Gen. Purchasing Agt., Isthmian Canal Comn., Washington, D. C., for furnishing emery wheels, iron buckets, bar iron, metallic tapes, etc.; also until Aug. 5, for furnishing 20,000 bbls. Portland cement.

Bids will be received by the Isthmian Canal Comn. at Washington, D. C. ,on Aug. 8 for tile flooring, cement, lime, creosote, etc., as advertised in The Engineering Record.

Philadelphia, Pa.—Bids were opened on July 17 by Maj. J. C. Sanford, Corps Engrs., for dredging in Delaware River between Fenns Point and south line of Pennsylvania. The bids were submitted in sections and the following have been recommended for acceptance: To Sanford & Brooks Co., Baltimore, Md., for Section 3, Subsection A—1,957,000 cu. yds. 15.45 cts. per cu. yd.; total, $302,356. To the Maryland Dredging Co., Baltimore, Md., for Section 3, Subsection B—1,957,000 cu. yds. 15.4 cts. per cu. yd.; total, $301,378, and to the American Dredging Co., of Philadelphia, for Section 4, Subsections A and B—4,227,000 cu. yds. at 14 cts. per cu. yd.. total, $602,350. Also same company for Section 5, Subsection A—2,700,000 cu. yds. 15.5 cts.; total, $418,500.

P. Sanford Ross, of Jersey City, N. J., submitted the only bid on July 17 to Maj. J. C. Sanford, for constructing 9,200 lin. ft. bulkhead, $37; changing from 3-row to 5-row construction of bulkhead 1,100 lin. ft., $18; and for construction of revetment, including stone riprap, 1,600 lin. ft., $17.50.

Pittsburg, Pa.—Bids will be received until Aug. 10 by Maj. Wm. L. Sibert, Corps Engrs., U. S. A., for dredging the approaches to Lock No. 6, Ohio River.

Charleston, S. C.—No bids were received on July 20 by Capt. G. P. Howell, Corps Engrs., U. S. A., for removal of wreck of schooner Kate V. Aitken, in Charleston Harbor.

Memphis, Tenn.—Bids will be received on Aug. 15 for the construction of 2 subways under Broadway; probable cost, $100,000. Address J. A. Omberg, City Engr.

Norfolk, Va.—The following are the bids opened on July 20 by Capt. E. E. Winslow, Corp Engrs., U. S. A., for dredging (*a*) North River Bar, N. C., 16,000 cu. yds.; (*b*) Currituck Sound, N. C., 8,000 cu. yds.; (*c*) Elizabeth River, Va., 20,000 cu. yds.: Chas. P. Grim, 515 Girard Bldg., Philadelphia, Pa.—a 39 cts.; b 34 cts.; c 24 cts, Norfolk Dredging Co., Norfolk, Va.—*a* 41½ cts.; *b* 36½ cts; c 24½ cts.

La Crosse, Wis.—Frank Powell, city engineer, writes that the proposed new causeway over the marsh connecting the north and south sides will cost about $20,000.

Milwaukee, Wis.—City Engr. Chas. J. Poetsch is reported to be preparing plans for straightening the channel of the Kinnickinnic River.

Havana, Cuba.—Press reports state that bids will be received until Nov. 9 by the Cuban Government at Havana, for the construction of a wharf, custom house, appraisers' office, and for a public wharf in Havana Harbor; probable cost of work, $1,000,000. The plans and specifications can be seen at the office of the Cuban Consulate General, 96 Wall St.

Mill Cove, N. S.—Bids will be received until August 4 by the Dept. Pub. Wks. (Fred. Gelinas, Secy.), at Ottawa, Ont., for constructing a breakwater at Mill Cove.

Port Arthur, Ont.—J. McTergue, Town Clk., writes in regard to the construction of a dam on Current River that estimated have not yet been completed, simply examinations and explorations of drainage area. For further information address D. J. Russell Duncan, Town Engineer.

PROPOSALS OPEN

For Proposals see pages 56, 57, 60 61, 62 63 AND 66

WATER WORKS.

Bids Close.		See Eng. Record.
Aug. 1.	Charleston, N. H.	Jul. 8
Aug. 1.	Laying pipe, etc., Cincinnati, O.......	Jul. 8

Items marked thus give the names of parties awarded contracts.

	Adv. Jul. 8 to 22.	
Aug. 1.	Distribution system, Ashland, Pa. Adv. Jul. 22 to 29.	Jul. 22
Aug. 1.	Reservoir dam, Longmont, Colo. Adv. Jul. 22.	Jul. 22
Aug. 2.	Expert services, Chicago, Ill.	Jul. 29
Aug. 3.	Mains, Madison, S. D.	Jul. 22
Aug. 3.	Water wks., Mascoutah, Ill.	Jul. 22
Aug. 3.	Dam, Augusta, Me. Adv. Jul. 29.	Jul. 29
Aug. 3.	Reservoir, Lake Placid, N. Y. Av. Jul. 29.	Jul. 29
Aug. 4.	Reservoir, Bloomington, Ill.	Jul. 29
Aug. 5.	Mains, Norwood, O.	Jul. 15
Aug. 5.	Water wks., Barnesville, Minn.	Jul. 22
Aug. 5.	Mains, Seattle, Wash.	Jul. 29
Aug. 7.	Pumping plant, Winnipeg, Man. Adv. Jul. 8 to 22.	Jul. 8
Aug. 7.	Filter plant, St. Cloud, Minn.	Jul. 15
Aug. 7.	Pipe, Homestead, Pa.	Jul. 15
Aug. 7.	Pipe, etc., Falmouth, Mass. Adv. Jul. 29.	Jul. 29
Aug. 8.	Water works, Columbia, S. C. Adv. Jul. 1, 8, 22.	Jul. 1
Aug. 8.	Pipe, etc., Cincinnati, O.	Jul. 22
Aug. 8.	Water wks., Hammond, La.	Jul. 22
Aug. 8.	Dam, pipe line, etc., Oneida, N. Y. Adv. Jul. 22.	Jul. 22
Aug. 8.	System, Republic, Mich.	Jul. 29
Aug. 8.	Pipe, valves, etc., Troy, N. Y.	Jul. 29
Aug. 9.	Improv., Ft. Revere, Hull, Mass.	Jul. 22
Aug. 9.	Pumping Station, Brooklyn, N. Y.	Jul. 29
Aug. 9.	Expert services, Chicago, Ill.	Jul. 29
Aug. 9.	Reservoir, Franklin, N. H.	Jul. 29
Aug. 10.	Water wks., Cottage Grove, Ore.	Jul. 29
Aug. 10.	Water wks., Bolivar, Tenn.	Jul. 29
Aug. 11.	Stand pipe and tank, Grand Rapids, Mich. Adv. Jul. 22 to 29.	Jul. 22
Aug. 12.	Water wks., Newark, O. Adv. Jul. 15 to 29.	Jul. 15
Aug. 14.	Pipe, etc., Lyndhurst, N. J. Adv. Jul. 22 to 29.	Jul. 22
Aug. 14.	Mains, Grand Rapids, Mich.	Jul. 29
Aug. 14.	System, Lone Tree, Ia.	Jul. 29
Aug. 15.	Reservoir, etc., Ft. McPherson, Ga. Adv. Jul. 22 to 29.	Jul. 22
Aug. 16.	Dam, etc., Casper, Wyo. Adv. Jul. 22 to 29.	Jul. 22
Aug. 17.	Irrigation, Yuma, Ariz. Adv. Jun. 17 to Jul. 22.	Jun. 17
Aug. 24.	System, Marksville, La.	Jul. 29
Aug. 25.	Pipe, etc., Panama Adv. Jul. 29.	Jul. 29
Aug. 26.	Reservoir, Ft. Moultrie, S. C.	Jul. 29
Aug. 26.	Boiler, Ft. Ringgold, Tex.	Jul. 29
Aug. 28.	Canal, etc., Montrose, Colo. Adv. Jul. 15 to 29	Jul. 15
Aug. 30.	Improv., Owensboro, Ky.	Jul. 15
Aug. —.	Improv., Donalsonville, La.	Jul. 15
Sept. 5.	Dam, etc., Cody, Wyo. Adv. Jul. 15 to 29.	Jul. 15
Sept. 6.	Tunnel, etc., Cody, Wyo. Adv. Jul. 15 to 29.	Jul. 15
Oct. 12.	Sale of standpipe, Attleboro, Mass. Adv. Jul. 29.	Jul. 29
———	Water wks., Utica, Miss.	Jul. 15
———	Water wks. or franchise, Muncie, Ind. Adv. Jul. 29.	Jul. 29

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 1.	Toronto, Ont.	Jun. 17
Aug. 1.	Washington, D. C. Adv. Jul. 8 to 29.	Jul. 8
Aug. 1.	Charleston, N. H.	Jul. 8
Aug. 1.	Anaconda, Mont.	Jul. 8
Aug. 1.	Lake Placid, N. Y.	Jul. 15
Aug. 1.	Windom, Minn.	Jul. 22
Aug. 1.	Warren, O.	Jul. 29
Aug. 1.	Gallitzin, Pa.	Jul. 29
Aug. 2.	Pipestone, Minn.	Jul. 15
Aug. 2.	Wyandotte, Mich.	Jul. 22
Aug. 2.	Brooklyn, N. Y.	Jul. 29
Aug. 2.	Chicago, Ill.	Jul. 29
Aug. 2.	Perry, Ia.	Jul. 29
Aug. 2.	Gulfport, Miss.	Jul. 29
Aug. 3.	Massillon, O.	Jul. 22
Aug. 3.	Pittston, Pa.	Jul. 29
Aug. 4.	Columbus, O.	Jul. 29
Aug. 5.	Alliance, O.	Jun. 24
Aug. 5.	West Haverstraw, N. Y. Adv. Jul. 22 to 29.	Jul. 22
Aug. 5.	Phillipsburg, N. J. Adv. Jul. 29.	Jul. 29
Aug. 7.	Anaconda, Mont.	Jul. 29
Aug. 8.	West Point, N. Y. Adv. Jul. 15 to 29.	Jul. 15
Aug. 8.	Tell City, Ind.	Jul. 29
Aug. 9.	Indianapolis, Ind.	Jul. 29
Aug. 11.	Cincinnati, O.	Jul. 15
Aug. 11.	Grand Rapids, Mich. Adv. Jul. 22 to 29.	Jul. 22
Aug. 12.	Norwood, O.	Jul. 22
Aug. 14.	Cincinnati, O.	Jul. 22
Aug. 15.	New Britain, Conn. Adv. Jul. 29.	Jul. 29
Aug. 16.	Winchester, Ind.	Jul. 29
Aug. 19.	Norwood, O.	Jul. 29
Aug. 21.	Steubenville, O. Adv. Jul. 29.	Jul. 29
Aug. 23.	Chicago, Ill. Adv. Jul. 29.	Jul. 29
Aug. 24.	Clinton, Ia.	Jul. 29

BRIDGES.

Aug. 1.	Elmira, N. Y. Adv. Jul. 15, 22.	Jul. 15
Aug. 1.	New York, N. Y.	Jul. 29
Aug. 2.	Atlantic City, N. J.	Jul. 29
Aug. 2.	Dallas, Tex.	Jul. 29
Aug. 2.	Boulder, Colo.	Jul. 29
Aug. 3.	Springfield, O. Adv. Jul. 29.	Jul. 29
Aug. 5.	Ft. Pierre, S. D.	Jul. 29
Aug. 7.	Mt. Clemens, Mich.	Jul. 22
Aug. 7.	Marion, O.	Jul. 22
Aug. 7.	Frankfort, Ind.	Jul. 22
Aug. 7.	Clarksdale, Miss.	Jul. 22
Aug. 7.	Rensselaer, Ind.	Jul. 29
Aug. 7.	New Albany, Ind.	Jul. 29
Aug. 7.	Batesville, N. J.	Jul. 29
Aug. 8.	Merced, Cal.	Jul. 22
Aug. 8.	Fargo, N. D.	Jul. 22
Aug. 8.	Brownstown, Ind.	Jul. 29
Aug. 8.	Stockton, Cal.	Jul. 29
Aug. 9.	Salem, N. J. Adv. Jul. 29.	Jul. 29
Aug. 9.	Jacksonville, Fla.	Jul. 29
Aug. 10.	Bridgeport, Conn. Adv. Jul. 22 to 29.	Jul. 22
Aug. 10.	New York, N. Y.	Jul. 22
Aug. 11.	Stockton, Mo.	Jul. 29
Aug. 15.	St. Clairsville, O.	Jul. 29
Aug. 16.	Cleveland, O.	Jul. 29
Aug. 19.	Norristown, Pa.	Jul. 29
Sept. 8.	Virginia City, Mont.	Jul. 22

PAVING AND ROADMAKING.

Aug. 1.	Belvidere, Ill.	May 20
Aug. 1.	Elizabeth, N. J.	Jul. 15
Aug. 1.	Denver, Colo.	Jul. 22
Aug. 1.	Bayonne, N. J. Adv. Jul. 22 to 29.	Jul. 22
Aug. 1.	Valley Forge, Pa.	Jul. 22
Aug. 1.	Buffalo, N. Y.	Jul. 22
Aug. 1.	New York, N. Y.	Jul. 29
Aug. 1.	Troy, N. Y.	Jul. 29
Aug. 1.	Petersburg, Ill.	Jul. 29
Aug. 1.	Peru, Ill.	Jul. 29
Aug. 2.	Brooklyn, N. Y.	Jul. 29
Aug. 2.	Baltimore, Md.	Jul. 29
Aug. 2.	Chicago, Ill.	Jul. 29
Aug. 3.	Springfield, Mass.	Jul. 15
Aug. 3.	Pittston, Pa.	Jul. 29
Aug. 4.	Washington, D. C. Adv. Jul. 15 to 29.	Jul. 15
Aug. 4.	Richmond, Ind.	Jul. 29
Aug. 5.	Panama	Jul. 8
Aug. 5.	Bricks, Panama	Jul. 15
Aug. 5.	Seattle, Wash.	Jul. 29
Aug. 5.	Wilmington, Del.	Jul. 29
Aug. 7.	Martinsville, Ind.	Jul. 15
Aug. 7.	Greensburg, Pa.	Jul. 15
Aug. 7.	Greensburg, Ind.	Jul. 22
Aug. 7.	Green Bay, Wis.	Jul. 22
Aug. 7.	Dunkirk, Ind.	Jul. 29
Aug. 7.	English, Ind.	Jul. 29
Aug. 7.	Auburn, N. Y.	Jul. 29
Aug. 7.	Columbus, Ind.	Jul. 29
Aug. 8.	Shreveport, La.	Jul. 1
Aug. 8.	Corydon, Ind.	Jul. 22
Aug. 8.	Knox, Ind.	Jul. 22
Aug. 8.	Vincennes, Ind.	Jul. 22
Aug. 8.	Logansport, Ind.	Jul. 22
Aug. 8.	Auburn, N. Y.	Jul. 22
Aug. 8.	New Brighton, S. I.	Jul. 29
Aug. 8.	Washington, D. C.	Jul. 29
Aug. 8.	Knoxville, Tenn.	Jul. 29
Aug. 9.	Indianapolis, Ind.	Jul. 29
Aug. 11.	Cincinnati, O.	Jul. 15
Aug. 11.	Madisonville, O.	Jul. 29
Aug. 11.	Napoleon, O.	Jul. 29
Aug. 12.	Scottsburg, Ind.	Jul. 29
Aug. 12.	Norristown, Pa.	Jul. 29
Aug. 14.	Cincinnati, O.	Jul. 22
Aug. 15.	Crownpoint, Ind.	Jul. 22
Aug. 15.	Mobile, Ala.	Jul. 29
Aug. 17.	Cincinnati, O.	Jul. 29
Aug. 19.	Norwood, O.	Jul. 29
Aug. 21.	Johnstown, N. Y.	Jul. 22
Aug. 28.	Asphalt plant, New Orleans, La. Adv. Jul. 29.	Jul. 29

POWER, GAS AND ELECTRICITY.

Aug. 1.	Durant, Miss.	Jul. 15
Aug. 2.	Indianapolis, Ind.	Jul. 8
Aug. 3.	Lake Placid, N. Y. Av. Jul. 29.	Jul. 29
Aug. 4.	Jacksonville, Fla.	Jul. 22
Aug. 7.	Girardville, Pa.	Jul. 22
Aug. 8.	Electric supplies, Pensacola, Fla.	Jul. 29
Aug. 8.	Washington, D. C.	Jul. 29
Aug. 10.	Bellefontaine, O.	Jul. 15
Aug. 10.	El. light fixtures, Washington, D. C.,	Jul. 22
Aug. 10.	Bolivar, Tenn.	Jul. 29
Aug. 15.	Campbellsville, Ky.	Jun. 24
Aug. 15.	Electric light fixtures, Pekin, Ill.	Jul. 29
Aug. 15.	Russell, Ky.	Jul. 29
Aug. 15.	Pulaski, Va.	Jul. 29
Aug. 19.	Ft. Myer, Va. Av. Jul. 29.	Jul. 29
Aug. 24.	Fort Wayne, Ind.	Jul. 8
Aug. 24.	Marksville, La.	Jul. 29
Aug. 28.	Washington, D. C. Adv. Jul. 29.	Jul. 29
Oct. 1.	Tacoma, Wash.	Jul. 8
Aug. —.	Waukegan, Ill.	Jul. 29

BUILDINGS.

Aug. 1.	Power house, Wash., D. C.	Jul. 15
Aug. 1.	**Y. M. C. A. Bldg., Spokane, Wash.**	**Apr. 29**
Aug. 1.	Library, Louisville, Ky.	Jul. 1
Aug. 1.	School, Port Arthur, Tex.	Jul. 8
Aug. 1.	Lighthouse bldgs., Mobile, Ala.	Jul. 8
Aug. 1.	School, Washington, D. C.	Jul. 8
Aug. 1.	Capitol, Frankfort, Ky. Adv. Jul. 15.	Jul. 15
Aug. 1.	Hospital, Higginsville, Mo.	Jul. 15
Aug. 1.	School, Dublin, Ga.	Jul. 29
Aug. 1.	Courthouse, Stanton, Mich.	Jul. 29
Aug. 1.	College bldgs., Scottsville, Ky.	Jul. 29
Aug. 1.	Hospital, Buffalo, N. Y.	Jul. 29
Aug. 1.	Library, South Haven, Mich.	Jul. 29
Aug. 1.	Y. M. C. A. bldg., Fargo, N. D.	Jul. 29
Aug. 2.	Tunnel at school, Waukesha, Wis.	Jul. 29
Aug. 2.	Hospital, Monson, Mass.	Jul. 29
Aug. 2.	School, Havre de Grace, Md.	Jul. 29
Aug. 3.	Post bldgs., Cascade Locks, Ore.	Jul. 15
Aug. 3.	Pub. bldgs., Brooklyn, N. Y.	Jul. 22
Aug. 4.	School, Girard, O.	Jul. 22
Aug. 4.	Hospital, New York, N. Y.	Jul. 29
Aug. 4.	Htg. school, Geneseo, N. Y.	Jul. 29
Aug. 5.	Pub. bldg., Bremerton, Wash.	Jul. 1
Aug. 5.	Pub. bldg., Hot Springs, S. D.	Jul. 15
Aug. 5.	Infirmary, Carthage, O.	Jul. 15
Aug. 5.	School, Durham, N. C.	Jul. 29
Aug. 5.	Church, Clinton, Ia.	Jul. 29
Aug. 7.	P. O. Bldg., Adrian, Mich. Adv. Jul. 1, 8.	Jul. 1
Aug. 7.	Infirmary, Latonia, Ky.	Jul. 15
Aug. 7.	Post-Office improv., Calgary, Alta.	Jul. 15
Aug. 7.	Hospital, Rome, N. Y. Adv. Jul. 15 to 29.	Jul. 15
Aug. 7.	Pub. bldg. supplies, Panama	Jul. 15
Aug. 7.	School, Athens, Ga.	Jul. 15
Aug. 7.	Hospital, Ft. Wood, N. Y. Adv. Jul. 22 to 29.	Jul. 22
Aug. 7.	School, Carrick, Pa.	Jul. 29
Aug. 7.	School, St. Charles, Ill.	Jul. 29
Aug. 7.	Elks' bldg., Shreveport, La.	Jul. 29
Aug. 7.	Armory improv., Albany, N. Y.	Jul. 29
Aug. 8.	Htg. jail, Aberdeen, Miss.	Jul. 22
Aug. 8.	School, Minot, N. D.	Jul. 22
Aug. 8.	School, Englewood, N. J. Adv. Jul. 29.	Jul. 29
Aug. 8.	Stable, New Brighton, S. I.	Jul. 29
Aug. 8.	School, Maynard, Mass.	Jul. 29
Aug. 9.	Pub. bldgs., Chicago, Ill.	Jun. 17
Aug. 9.	School library, Bloomington, Ind. Adv. Jul. 8.	Jul. 8
Aug. 9.	Library, Louisville, Ky.	Jul. 22
Aug. 10.	Jail, Salem, Va.	Jul. 15
Aug. 10.	Church, Lexington, Tenn.	Jul. 29
Aug. 10.	Bank, Guin, Ala.	Jul. 29
Aug. 10.	School, Hackensack, N. J.	Jul. 29
Aug. 11.	Htg. library, Cincinnati, O.	Jul. 22
Aug. 11.	Masonic temple, New Augusta, Ind.	Jul. 29
Aug. 11.	Engine house, Chicago, Ill.	Jul. 29
Aug. 12.	School, Rocky River, O.	Jul. 22
Aug. 12.	School, Oakville, Mo.	Jul. 29
Aug. 12.	School, Columbus, O.	Jul. 29
Aug. 14.	Court House, Cedartown, Ga.	Jul. 8
Aug. 14.	U. S. Custom House, Baltimore, Md. Adv. Jul. 15, 22.	Jul. 15
Aug. 14.	School, Cleveland, O.	Jul. 22
Aug. 14.	Pub. bldg. improv., Cincinnati, O.	Jul. 22
Aug. 15.	Pub. bldgs, htg., etc., New York, N. Y. Adv. Jul. 29.	Jul. 29
Aug. 15.	School plans, Laurel, Miss.	Jul. 29
Aug. 15.	Jail improv., Crookston, Minn.	Jul. 29
Aug. 16.	P. O., McKeesport, Pa.	Jul. 15
Aug. 16.	Post bldgs., Ft. Mott, N. J. Adv. Jul. 22 to 29.	Jul. 22
Aug. 16.	School, Youngstown, O.	Jul. 29
Aug. 17.	Lighthouse, Buffalo, N. Y.	Jul. 15
Aug. 17.	P. O. extension, Burlington, Ia.	Jul. 15
Aug. 17.	School bldgs., Hayward, Wis.	Jul. 29
Aug. 19.	Pub. bldg., Portsmouth, N. H.	Jul. 29
Aug. 21.	Hospital, Southport, N. C.	Jul. 22
Aug. 22.	School, Santa Fe, N. M.	Jul. 29
Aug. 25.	School, La Moure, N. D.	Jul. 29
Aug. 26.	Htg. hotel, Cincinnati, O.	Jul. 22
Aug. 28.	Hospital bldgs., Buffalo, N. Y.	Jul. 29
Sep. 4.	Htg., etc., courthouse, Huntington, Ind.	Jul. 29

MISCELLANEOUS.

Aug. 1.	Supplies, Washington, D. C.	Jul. 8
Aug. 1.	Dredging, Boston, Mass.	Jul. 29
Aug. 1.	Levee, New Orleans, La.	Jul. 29
Aug. 2.	Dredging, Savannah, Ga. Adv. Jul. 8 to 29.	Jul. 8
Aug. 2.	Retaining walls, etc., Cincinnati, O. Adv. Jul. 15, 22.	Jul. 15
Aug. 2.	Drains, Adel, Ia.	Jul. 22
Aug. 2.	Lumber, Panama	Jul. 22
Aug. 3.	Dredging, Seattle, Wash.	Jul. 15
Aug. 3.	Dredging, Cape Charles, Va. Adv. Jul. 8, 22.	Jul. 8
Aug. 3.	Dredging, New London, Conn. Adv. Jul. 22 to 29.	Jul. 22
Aug. 3.	Levee wks., Elsberry, Mo.	Jul. 22
Aug. 3.	Levee work, Bossier City, La.	Jul. 29
Aug. 3.	Emery wheels, etc., Panama	Jul. 29
Aug. 4.	Ditch, Rensselaer, Ind.	Jul. 15
Aug. 4.	Breakwater, Mill Cove, N. S.	Jul. 29
Aug. 5.	Cement, Panama	Jul. 29
Aug. 5.	Weir, Sacramento, Cal.	Jul. 29
Aug. 7.	Beacon superstructure, Buffalo, N. Y.,	Jul. 15
Aug. 7.	Ditch, Plymouth, Ind.	Jul. 29
Aug. 7.	Removal of snow, etc., New York, N. Y.	Jul. 29
Aug. 8.	Dredge work, Wauseon, O.	Jul. 15
Aug. 8.	Ditch, Cleveland, O.	Jul. 22
Aug. 8.	Levee work, Walnut Hill, Ark.	Jul. 22
Aug. 8.	Cement, etc., Key West, Fla.	Jul. 29
Aug. 8.	Supplies, Washington, D. C.	Jul. 29
Aug. 8.	Cement, lime, etc., Panama Adv. Jul. 29.	Jul. 29
Aug. 9.	Dock, Chicago, Ill.	Jun. 17
Aug. 10.	Levee work, New Orleans, La. Adv. Jul. 15 to 29.	Jul. 15
Aug. 10.	Dredging, Los Angeles, Cal. Adv. Jul. 22.	Jul. 22
Aug. 10.	Dredging, Pittsburg, Pa.	Jul. 29
Aug. 11.	Levee work, New Orleans, La. Adv. Jul. 15 to 29.	Jul. 15
Aug. 11.	Supplies, Panama	Jul. 15
Aug. 11.	Dredging, Norfolk, Va. Adv. Jul. 22 to 29.	Jul. 22
Aug. 11.	Ditch, Valparaiso, Ind.	Jul. 29
Aug. 12.	Steel work, etc., Washington, D. C.,	Jul. 22
Aug. 14.	Dredging, Detroit, Mich. Adv. Jul. 15 to 29.	Jul. 15
Aug. 15.	Supplies, Washington, D. C.	Jul. 29
Aug. 15.	Cement, etc., Washington, D. C.	Jul. 29
Aug. 15.	Subways, Memphis, Tenn.	Jul. 29
Aug. 17.	Dredging, Norfolk, Va.	Jul. 15
Aug. 17.	Printing presses, etc., Panama Adv. Jul. 22 to 29.	Jul. 22
Aug. 18.	Dredging, Newport, R. I. Adv. Jul. 22 to 29.	Jul. 22
Aug. 18.	Inlet wall, San Francisco, Cal. Adv. Jul. 22 to 29.	Jul. 22
Aug. 19.	Dredges, Panama Adv. Jul. 22 to 29.	Jul. 22
Aug. 19.	Boring in Lake Michigan, Chicago, Ill.	Jul. 29
Aug. 21.	Steel bars, Glendive, Mont. Adv. Jul. 15 to 29.	Jul. 15
Aug. 21.	Garb. disposal, Indianapolis, Ind.	Jul. 22
Aug. 21.	Crane for sewer, Washington, D. C. Adv. Jul. 22 to 29.	Jul. 22
Aug. 21.	Dredging, Wilmington, Del.	Jul. 29
Aug. 22.	Drills, etc., Panama Adv. Jul. 22 to 29.	Jul. 22
Aug. 26.	**Coal plant, Olongapo, P. I.**	**May 6**
Aug. 26.	Filling etc., Key West, Fla.	Jul. 22
Aug. 29.	Machines, etc., San Francisco, Cal.	Jul. 29
Sep. 1.	**Steel and iron, Sydney, N. S. Wales.** **Adv. Apr. 8, 22; May 6, 20; Jun. 3, 17.** Adv. Jul. 1, 15.	**Apr. 8**
Sep. 1.	Crane, Augusta, Ga.	Jul. 29
Sep. 9.	R. R. work, Miami, Fla. Adv. Jul. 29.	Jul. 29
Nov. 1.	**R. R. work, Manila, P. I.**	**Jun. 17**
Nov. 9.	Wharf, etc., Havana, Cuba	Jul. 29
Jan. 1.	Statue plans, Indianapolis, Ind.	Jul. 22
Apr. 2,	**'06. Harbor Work, Valparaiso, Chili,** Adv. Apr. 29 to Jul. 29.	**Apr. 29**
———	**Dam, etc., Charlestown, W. Va.** Adv. Jul. 8, 15.	**Jul. 1**
———	R. R. work, Shreveport, La.	Jul. 29
———	Garb. disposal, Washington, Pa. Adv. Jul. 29.	Jul. 29